EEE

Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 30149

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Third Semester

Electrical and Electronics Engineering

EE 3303 — ELECTRICAL MACHINES – I

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Differentiate statistically induced EMF from dynamically induced EMF. Give one example for each.

2. Why it is named as leakage flux?

3. Draw the pictorial view of armature flux and field flux positions in the air gap during demagnetizing and cross magnetizing situations of DC machine.

4. List the role of inter-poles in the DC machine.

5. Write the reason for higher starting current in DC motors.

6. Compare brake test with Swinburne's test of DC machine.

7. Sketch the phasor representation of ideal transformer on No load.

8. Name the major components (in practical setup) required to separate the components of core loss of the transformer.

9. List the drawback of autotransformer by comparing two winding transformer.

10. Write the advantages of three phase transformer.

PART B — (5 × 13 = 65 marks)

11. (a) (i) Derive the expression for the energy in singly excited magnetic field system. (7)

(ii) Write a technical note on doubly excited magnetic field system. (6)

Or

(b) (i) Develop the mathematical expression for the force and torque developed in the singly excited system. (7)

(ii) The magnetic circuit has dimensions, cross sectional area of core = cross sectional area of air-gap = 8 cm^2, air-gap length = 0.055 cm, mean core length = 30 cm and N = 520 turns. Assume the value, μ_r = 65,000 for core material. Find (1) the reluctances of the core and air-gap, for the condition that the magnetic circuit is operating with flux density in the core = 1.0 T, (2) the flux and (3) the current. (6)

12. (a) (i) Explain, why EMF is induced in the DC machine. Draw the wave shape of the EMF induced in the machine with split-ring and with slip-ring assembly. Also derive the mathematical expression for the EMF induced in the DC machine. (7)

(ii) A DC generator has an EMF of 100 V, when the useful flux per pole is 20 mWb and the speed is 800 rpm. Calculate the generated EMF (1) with same flux and a speed of 1000 rpm; (2) with a flux per pole of 24 mWb and a speed of 940 rpm. (6)

Or

(b) (i) Draw and explain the magnetization and load characteristics of separately excited DC machine and self-excited DC machine. (7)

(ii) Two shunt generators running in parallel with a load current of 3000 A. The generators have armature resistances 0.05 Ω and 0.03 Ω. The field resistances are 30 Ω and 25 Ω. The induced EMFs are 400 V and 380 V. Calculate

(1) current supplied by each generator;

(2) bus-bar voltage and

(3) kW output of each generator. (6)

13. (a) (i) Derive the expression for the torque developed in the DC machine. Also list the factors affecting the torque developed. (7)

(ii) The armature resistance of a 200 V DC shunt motor is 0.12 Ω. It runs at 600 rpm at constant torque load and draws a current of 21 A. Calculate its new speed if the field current is reduced to 10%. (6)

Or

(b) (i) From the basic principles, derive the condition for the maximum efficiency in the DC machine. (7)

(ii) Two DC generators A and B are connected to a common load. Machine A had a constant EMF of 400 V and internal resistance of 0.25 Ω, while the machine B has a constant EMF of 410 V and internal resistance of 0.4 Ω. Calculate the current and power output from each generator if the load voltage is 390 V. What would be the current and power from each machine and the terminal voltage if the load was open circuited? (6)

14. (a) (i) Draw the per phase equivalent circuit (exact and approximate circuit) of single phase transformer with necessary assumptions by indicating different steps. (7)

(ii) Consider a 20 kVA, 2000/200 V, 50 Hz transformer. The SC test results are as follows: *SC test*: 80 V, 10 A, 290 W (HV side)

Determine the regulation at full load and half full load,

(1) 0.7 pf lag and

(2) 0.7 pf lead. (6)

Or

(b) (i) Write a technical note on the parallel operation of single phase transformer. (7)

(ii) A 5 kVA distribution transformer has a full load efficiency of 90 % at which copper loss equals Iron loss. The transformer is loaded 24 hours as given below. No load for 9 hours, 25% of full load for 6 hours, 50% of full load for 6 hours, and full load for 3 hours. Calculate all day efficiency of the transformer. (6)

15. (a) (i) Explain the construction and working of auto-transformer with neat sketches. (7)

(ii) With necessary circuit and derivation, prove that the Scott connection is used to convert three phase AC to two phase AC, if the phase angle between two phase is 90°. (6)

Or

(b) Elucidate the following phasor group of three phase transformer.

(i) any one arrangement for zero-degree phase displacement (7)

(ii) any one arrangement for 180° phase displacement. (6)

PART C — (1 × 15 = 15 marks)

16. (a) A 500 V shunt motor takes 8 A on no load. The armature and field resistances are 0.2 Ω and 250 Ω respectively, when measured at room temperature. Neglect the change in resistance due to temperature variation. Find the efficiency of the machine. (15)

(i) While running as a motor taking a line of 80 A at 500 V.

(ii) While running as a generator delivering a current of 90 A at 500 V. Assume the stray load losses to be 1.2% of the output power.

Or

(b) Calculate the values of equivalent circuit parameters referred to LV side of a single phase 3 kVA, 220/440 V, 50 Hz transformer with the following test results. (15)

Open circuit test (HV open): 220 V, 1 A, 100 W

Short circuit test (LV short): 20 V, 9 A, 75 W

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Question Paper Code : 30119

B.E./B.Tech DEGREE EXAMINATIONS, APRIL/MAY 2023.

Third Semester

Electrical And Electronics Engineering

CS 3353 – C PROGRAMMING AND DATA STRUCTURES

(Common to: Electronics and Communication Engineering/Electronics and Instrumentation Engineering/Electronics and Telecommunication Engineering/Instrumentation and Control Engineering)

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is the role of associativity in prioritizing the operators?

2. Define recursion.

3. Write short notes on 'enum'.

4. What is the role of pointers in call by reference.

5. List the advantages of linked list over arrays.

6. Name any four applications of queue in the field of computer applications.

7. Convert the infix expression to postfix : $(A - B / C) * (D / E - F)$

8. What is rehashing? When is it Preferred?

9. What is output of selection sort after second iteration for the number sequence: 15, 5, 43, 7, 25, 11

10. Is linear search is better than binary search? Why?

PART B — (5 × 13 = 65 marks)

11. (a) What is the use of looping? Explain about the entry - controlled and exit-controlled loops available in 'C' with appropriate sample C programs (13)

Or

(b) What is an array? List the various types of arrays. Elaborate on t – D array with an example. (13)

12. (a) (i) What is the significance of 'structure' in language C? Explain in detail with an example program. (10)

(ii) Enumerate the difference between structures and unions. (3)

Or

(b) (i) Explain the procedure to pass an array as argument to a function with an example program. (7)

(ii) Write brief notes on preprocessor directives. (6)

13. (a) (i) Write and explain the algorithms of enqueue and dequeue operations of queue. (7)

(ii) Write short notes on doubly linked list with few operations. (6)

Or

(b) (i) Write and explain the algorithms of peek and display operations of stack. (7)

(ii) With appropriate diagram explain any one application of queue. (6)

14. (a) (i) What is tree traversal? Explain various methods of traversals. (7)

(ii) Construct an expression tree for the expression $(p + r * q) + ((s * t + u) * v)$. What would be the output if inorder, preporder and postorder traversals are done. (6)

Or

(b) (i) What is a hash function? Explain the concept of hashing with example. (7)

(ii) Construct BST for the following: $\{20, 30, 10, 40, 50, -20, -30, 60\}$ (6)

15. (a) (i) Sort the following values using quick sort:

35,40,45,50,55,30,25,20,15 (9)

Illustrate each step of the sorting process.

(ii) Write and explain the algorithm of linear search. (4)

Or

(b) (i) Explain about the sorting algorithm that works based on divide and conquer technique. (7)

(ii) What are the advantages of linear search over binary search? Justify your observation with an example. (6)

PART C — (1 × 15 = 15 marks)

16. (a) (i) Convert the following arithmetic expression in infix form to post fix form using stack: $A + B / C + D * (E - F)$ ^ G (8)

(ii) Explain the procedure for string reversal using stack with suitable diagram. (7)

Or

(b) (i) Evaluate the following arithmetic expression using stack. 2*(4+3)−5 (8)

(ii) Explain the procedure for balanced parenthesis checker using stack with suitable diagram. (7)

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Question Paper Code : 30147

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Third Semester

Electrical and Electronics Engineering

EE 3301 – ELECTROMAGNETIC FIELDS

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

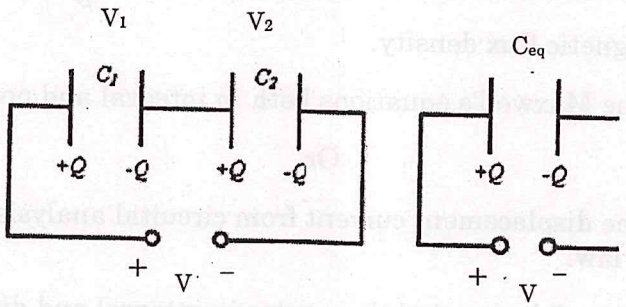
PART A — (10 × 2 = 20 marks)

1. State Divergence Theorem.

2. State Coulombs law.

3. Define potential difference with equation.

4. Formulate the total equivalent capacitance of two capacitor connected in series.



5. List the difference between Scalar and Vector Magnetic Potential.

6. State Ampere's circuital law.

7. Write the faraday's law equation for a moving charge in a constant magnetic field.

8. Write down the expression for electromotive force induced in the moving loop in static field B.

9. List the properties of uniform plane wave.

10. Outline the term 'skin depth'.

PART B — (5 × 13 = 65 marks)

11. (a) Calculate the electric field due to infinite line charge with charge density ρL.

Or

(b) Derive the potential due to

(i) Line charge (4)

(ii) Surface charge (4)

(iii) Volume charge (5)

12. (a) (i) Derive the boundary conditions for electric fields, between conductor and free space. (8)

(ii) Applying stokes theorem, derive continuity equation of current. (5)

Or

(b) (i) Derive the capacitance of a coaxial cable. (7)

(ii) Derive the capacitance of a spherical capacitor. (6)

13. (a) Find the total power passing through a circular disk of radius 5 cm in free space, given $\vec{H} = 0.2\, e^{-j\beta x}\vec{a}_z$.

Or

(b) Given electric field intensity in free space, $\vec{E} = \frac{50}{\rho}\cos(10^8 t - 10z)\vec{a}_\rho V/m$.

Find Magnetic flux density.

14. (a) Derive the Maxwell's equations both in integral and point forms.

Or

(b) Derive the displacement current from circuital analysis and from Ampere circuital law.

15. (a) Illustrate and derive poynting vector in integral and differential form.

Or

(b) Illustrate the propagation of uniform plane waves in two different medias with $(\varepsilon_1, \mu_1, \sigma_1)$ and $(\varepsilon_2, \mu_2, \sigma_2)$. Derive reflection coefficient and transmission coefficient of the wave, from the field components. (7+6)

PART C — (1 × 15 = 15 marks)

16. (a) In a material, for which $\sigma = 5.0\frac{s}{m}$ and $\varepsilon_r = 1$ and $\vec{E} = 250 \sin 10^{10} t (V/m)$.

Find the conduction and displacement current densities, and the frequency at which both have equal magnitudes. (5+5+5)

Or

(b) If $V = \left[2x^2 y + 20z - \frac{4}{x^2 + y^2} \right]$ volts.

Evaluate $\vec{E}$ and $\vec{D}$ at point P (6,-2.5,3) (8+7)

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Question Paper Code : 30136

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Third Semester

Electrical and Electronics Engineering

EC 3301 – ELECTRON DEVICES AND CIRCUITS

(Regulations 2021)

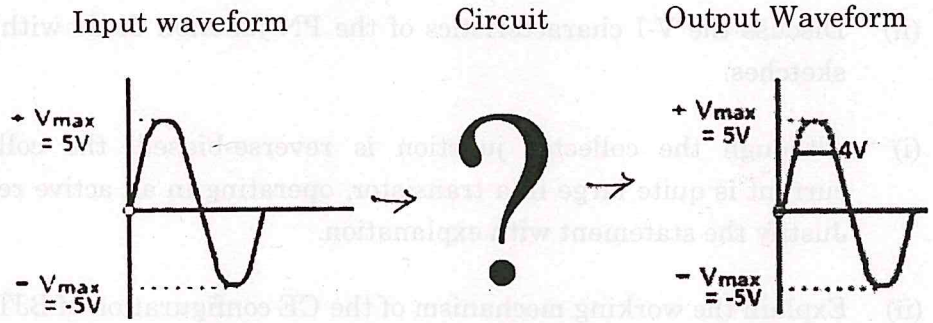
Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. List the necessity to use filters in conjunction with rectifiers.

2. Identify the diode circuit to get the following output waveform from the given input.



3. Recall the biasing arrangement for an NPN transistor to operate in the cut-off and saturation region.

4. Define intrinsic standoff ratio of UJT.

5. Recall the effects of coupling capacitors on the bandwidth of the amplifier

6. What is the significance of a small signal amplifier?

7. State Barkhausen criteria for amplifiers.

8. Compare voltage amplifier with power amplifier.

9. An amplifier has a gain of 300. When negative feedback is applied, the gain is reduced to 240. Find the feedback ratio.

10. In a Weinbridge oscillator, if the values of resistance, R=100KΩ and the frequency of oscillation is 10KHz, find the value of the capacitor, C.

PART B — (5 × 13 = 65 marks)

11. (a) (i) Draw the circuit of a full wave rectifier using two diodes and explain the principle of working with relevant diagrams (7)

(ii) The turns ratio of a transformer used in a Bridge Rectifier is 12:1. The primary is connected to the power mains: 220V, 50Hz. Assuming the diode voltage drops to zero,

(1) Calculate the D.C voltage across the load resistor.

(2) What is the PIV of the diode?

(3) If the same dc voltage is obtained by using Center tapped FWR, what is PIV? (6)

Or

(b) (i) A Zener diode can be used as a voltage regulator. Justify with its operation. (6)

(ii) Discuss the V-I characteristics of the PN junction diode with neat sketches. (7)

12. (a) (i) Although the collector junction is reverse-biased, the collector current is quite large in a transistor, operating in an active region. Justify the statement with explanation. (6)

(ii) Explain the working mechanism of the CE configuration of BJT. (7)

Or

(b) (i) Explain the negative resistance characteristics of the uni junction transistor with neat sketches. (6)

(ii) Summarize the operation and characteristic behaviour of JFET under various biasing conditions. (7)

13. (a) (i) Using the low-frequency hybrid model, obtain the expressions for voltage gain, current gain, input impedance, and output impedance for CE configuration. (6)

(ii) The transistor in the amplifier circuit shown in Fig. 13(a)(ii) has h – parameters, hie=2kΩ and hfe = 80. The value of hoe and hre are negligible. Calculate the voltage gain and input impedance Z_i(amp) of the amplifier. Capacitors C_1, C_2, and C_3 may be assumed short at signal frequency due to small impedances. (7)

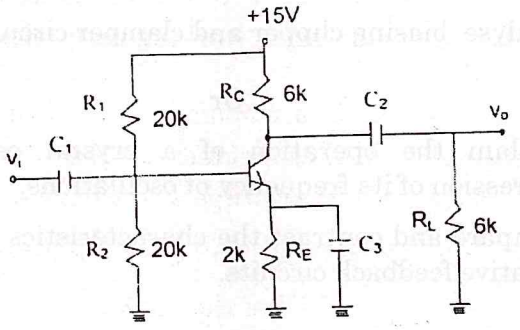


Fig. 13(a)(ii)

Or

(b) (i) Explain the high-frequency analysis of the CS amplifier. (7)

(ii) Compare CS, CD, and CG amplifiers. (6)

14. (a) (i) Analyze the effect of connecting a CB transistor to the CE amplifier on its input impedance and frequency response. (6)

(ii) Draw the block diagram of a 'n' stage cascaded amplifier and the expression for overall voltage gain. Also, determine the expression for bandwidth of a 'n' stage cascaded amplifier. (7)

Or

(b) (i) What is a differential amplifier? Explain its working. (6)

(ii) Summarize the importance of a single-tuned amplifier and explain is actual response. (7)

15. (a) (i) Draw the circuit of the Hartley oscillator and explain its working. Derive the expressions for frequency of oscillation and condition for starting of oscillation. (7)

(ii) With the necessary circuit diagram, explain the operation of a wein Bridge oscillator circuit. (6)

Or

(b) (i) Calculate the voltage gain, input, and output impedance of a voltage series feedback amplifier with A=500 $\beta = 0.01, R_i = 3K\Omega, R_0 = 20K\Omega$, and h_{fe}=–0.5 impedance. (6)

(ii) With appropriate derivations, discuss the effects of negative feedback on gain, bandwidth, input, and output impedances. (7)

PART C — (1 × 15 = 15 marks)

16. (a) (i) Elucidate the mechanism of avalanche and Zener breakdown. (7)

(ii) Analyse biasing clipper and clamper circuits with neat sketches. (8)

Or

(b) (i) Explain the operation of a crystal oscillator and derive its expression of its frequency of oscillations. (8)

(ii) Compare and contrast the characteristics of positive feedback with negative feedback circuits. (7)

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Question Paper Code : 30148

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Third Semester

Electrical and Electronics Engineering

EE 3302 — DIGITAL LOGIC CIRCUITS

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is the best example of digital system?

2. Define Nibble and Byte.

3. Define Boolean algebra and Boolean Expression.

4. State De Morgan's theorem.

5. Difference between Combinational & Sequential Circuits.

6. What are the classifications of sequential circuits?

7. How can the hazards in combinational circuit be removed?

8. What is static 1 hazard?

9. What are the types of gate arrays in ASIC?

10. Give the different bitwise operators.

PART B — (5 × 13 = 65 marks)

11. (a) (i) Draw the circuit diagram and explain the working of TTL inverter with tristate out

(ii) Explain the concept and implementation of ECL logic family.

Or

(b) (i) Explain the operation of TTL NAND gate with a neat circuit diagram. (8)

(ii) Draw the circuit of CMOS NOR gate and explain its operation. Mention any two points about the advantages of CMOS over the other digital logic families. (5)

12. (a) Obtain the minimum SOP using K-map.

$F=M_0+M_2+M_4+M_8+M_9+M_{10}+M_{11}+M_{12}+M_{13}$

Or

(b) Using 8:1 multiplexer, realize the Boolean function
T=f (w,x,y,z) = m (0,1,2,4,5,7,8,9,12,13)

13. (a) A sequential circuit has four flip flops ABCD and an input x is described by the following state equations.

$A(t+1) = (CD'+C'D)x + (CD + (CD)')x'$

$B(t+1) = A$

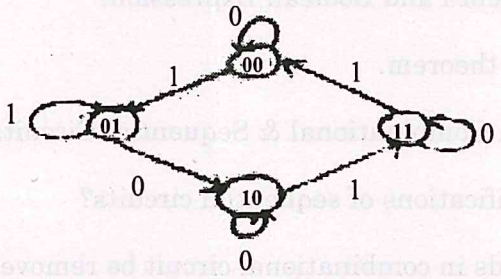
$C(t+1) = B$

$D(t+1) = C$

Obtain the sequence of states when x = 1 starting from state ABCD = 0001 Obtain the sequence of states when x = 10 starting from state ABCD = 0000

Or

(b) Design a synchronous sequential circuit using JK for the given state diagram.



14. (a) Develop the state diagram and primitive flow table for a logic system that has two inputs S and R and a single output Q. The device is to be an edge triggered SR flip-flop but without a clock. The device changes state on the rising edges of the two inputs. Static input values are not to have any effect in changing the Q output.

Or

(b) Design an asynchronous sequential circuit that has two inputs X_2 and X_1 and one output Z. The output is to remain a 0 as long as X_1 is a 0. The first change in X_2 that occurs while X_1 is a 1 will cause a Z to be a 1. Z is to remain a 1 until X_1 returns to 0. Construct a state diagram and flow table. Determine the output equations.

15. (a) Write a VHDL module that implements a full adder using an array of bit-vectors to represent the truth table.

Or

(b) (i) Write HDL behavioral description of JK flipflop using if- else statement based on value of present state. (8)

(ii) Draw the logic diagram for the following module. (5)

```
module seqcrt (A,B,C,Q,CLK);
input A,B,C,CLK;
output Q: reg Q,E;
always @ (Posedge CLK) begin E<= A&B;
Q <=E / C;
end end module
```

PART C — (1 × 15 = 15 marks)

16. (a) An asynchronous sequential circuit has two internal states and one output. The excitation and output functions describing the circuit are

$$Y_1 = X_1 + X_1Y_2' + X_2Y_1 \; Y_2 = X_2 + X_1Y_1' \; Y_2 + X_1Y_1, \; Z = X_2 + Y_1$$

(i) Draw the logic diagram of the circuit. (5)

(ii) Derive the transition table and output map. (5)

(iii) Obtain a flow table for the circuit. (5)

Or

(b) Design an asynchronous binary toggle circuit that changes state with each rising edge of clock input. Assume the initial output as zero.

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Question Paper Code : 30239

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Third Semester

Electrical and Electronics Engineering

MA 3303 — PROBABILITY AND COMPLEX FUNCTIONS

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Note : Statistical table to be permitted.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the axioms of probability?

2. Give the moment generating function of Binomial and Poisson distributions.

3. Define Central limit theorem.

4. Define covariance of random variables X and Y. Define their independence using covariance.

5. What are the necessary conditions for a function to be analytic?

6. What is conformal mapping?

7. Show that $\oint_c \frac{dz}{z-a} = 2\pi i$, where '$a$' is any point within simple closed curve 'C'.

8. Find the nature of singularity of $f(z) = \frac{z - \sin z}{z^2}$.

9. Solve the differential equation $(D^2 + 5D + 6)y = 0$.

10. Why does the method of undetermined coefficients fail when trial solution is assumed as $X = \tan x$.

PART B — (5 × 16 = 80 marks)

11. (a) (i) A manufacturer of tablets receives its LED screens from three different suppliers B_1, B_2 and B_3. The probability that any one LED screen received by the plant comes from these three suppliers are, 0.60, 0.30 and 0.10 respectively. Suppose that 95% of the LED screens from B_1, 80% of those from B_2 and 65% of those from B_3 perform according to specifications. What is the probability that the LED screen received from any plant, performs according to specification. Also find the probability that LED screen working under specification has come from (1) Supplier B_1, (2) Supplier B_2, (3) Supplier B_3. (8)

(ii) Each sample of water has a 10% chance of containing a particular organic pollutant. Assume that the samples are independent with regard to the presence of the pollutant. Find the probability that in the next 18 samples, (8)

(1) Exactly 2 contain pollutant.

(2) Atleast four samples contain pollutant.

Or

(b) (i) The maximum attenuation occurring in the barcode scanner, changes from product to product. After collecting considerable data, the engineers decided to model the variation occurring as normal distribution with mean 10.1 dB and standard deviation 2.7 dB. For the next product what is the probability that its maximum attenuation is between 8.5 dB and 13.0 dB. Also what proportion of the products has maximum attenuation greater than 15.1 dB? (8)

(ii) In a large corporate network, the time interval between user log-ons to the system can be modelled as exponential distribution with mean 1/25 log-ons per hour. What is the probability that (8)

(1) There are no log-ons in an interval of six minutes?

(2) The time until next log-on is between two and three minutes?

(3) Determine the interval time such that the probability that no log-on occurs in the interval is 0.90.

12. (a) Determine the value of c that makes the function $f(x,y)=c(x+y)$, a joint probability mass function over the nine points with $x=1,2,3$ and $y=1,2,3$. (16)

(i) What is the marginal probability distribution of random variable X and Y?

(ii) What is the conditional probability distribution of Y given X = 1?

(iii) Find $P(X<2,Y<2)$, $P(X=1,Y<2)$

(iv) Find covariance (X, Y). Are X and Y independent?

Or

(b) An engineer conducts an experiment with the purpose of showing that adding a new component to the existing metal alloy increases the cooling rate. Let X denote the percentage of the new component present in the metal. Let Y denote the cooling rate, during a heat treatment stage in degree Fahrenheit per hour. The observed data are

X	0	1	2	2	4	4	5	6
Y	25	20	30	40	45	50	60	50

Fit a simple linear regression equation, for the given data. Estimate the value of cooling rate when new component percentage is 5.5%, using the fitted equation. Calculate the residuals and the error sum of squares of the fitted line. Estimate the correlation coefficient of the given data. (16)

13. (a) (i) If $f(z)$ is analytic function with constant modulus, show that $f(z)$ is constant. (8)

(ii) If $\omega=\phi+i\psi$ represents the complex potential for an electric field and $\psi=x^2-y^2+\dfrac{x}{x^2+y^2}$ determine the function . (8)

Or

(b) (i) Find the bilinear transformation which maps the points $z=1,i,-1$ onto the points $w=i,0,-i$ Hence find the image of $|z|<1$. (8)

(ii) Interpret the transformation of points from z-plane to w-plane by (1) Translation, (2) Rotation, (3) Inversion. (8)

BEE2

14. (a) (i) State and prove Cauchy's integral theorem. (8)

(ii) Evaluate the integral $\oint_C \frac{\sin \pi z^2 + \cos \pi z^2}{(z-1)(z-2)} dz$, where C is the circle $|z| = 3$, using Cauchy's integral formula. (8)

Or

(b) (i) Find the Laurent's expansion of $f(z) = \frac{7z-2}{(z+1)z(z-2)}$ in the region $1 < z+1 < 3$. (8)

(ii) Evaluate $\int_{-\infty}^{\infty} \frac{x^2 dx}{(x^2+1)(x^2+4)}$, using Cauchy Residue integral. (8)

15. (a) (i) Solve the differential equation $(D^2 + D + 1)y = (1 - e^x)^2$. (8)

(ii) Using method of variation of parameters, solve the differential equation $\frac{d^2y}{dx^2} + 4y = \tan 2x$. (8)

Or

(b) (i) Solve the Legendre's linear equation

$$(1+x)^2 \frac{d^2y}{dx^2} + (1+x)\frac{dy}{dx} + y = 2\sin[\log(1+x)]. \quad (8)$$

(ii) Solve the simultaneous equations $\frac{dy}{dt} + 5x - 2y = t$, $\frac{dy}{dt} + 2x + y = 0$. (8)

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Question Paper Code : 30152

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Fourth Semester

Electrical and Electronics Engineering

EE 3403 — MEASUREMENTS AND INSTRUMENTATION

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Write two applications for smart sensors

2. The number of pulses counted by a digital frequency meter is 4 for a gating signal duration of 10 ms. Compute the unknown frequency.

3. How could one overcome gross errors while making measurements?

4. A voltmeter read as follows: 112.5, 112.0, 112.2, 112.3 and 112.4. If the actual reading is 112.1V, find the random error.

5. Write the expressions for the deflecting and controlling torques in a moving coil meter, defining each symbol in it.

6. Why is a moving iron device not suited for measuring direct voltages and currents?

7. Write any two limitations of wheat stone bridge.

8. 12V dc was input to a wheat stone bridge. The ratio arm impedances were 400 Ω and 200 Ω. A 560 Ω standard resistor was connected in the third arm. Find the magnitude of resistance in the unknown arm.

9. Draw the circuit of a LVDT device.

10. Define a virtual instrument.

PART B — (5 × 13 = 65 marks)

11. (a) Draw the block diagram of a measurement system and explain about each functional element in it.

Or

(b) Explain in detail about instrumental errors, their classification and remedial step taken in the case of occurrence of such errors.

12. (a) With neat diagrams, explain the working of dynamometer wattmeter and write the expression for average deflecting torque while measuring ac power.

Or

(b) Explain the construction and principle of working of induction type wattmeter.

13. (a) Derive the expression for unknown inductance using Maxwell's bridge.

Or

(b) State the conditions for an ac bridge to be balanced. Draw the circuit diagram of a schering's bridge and derive the expressions for the unknown quantities.

14. (a) Explain why the ac tachometer deviates from linearity characteristics at high speeds.

Or

(b) With a circuit explain the working of a thermistor and explain why it is not suited at high temperatures.

15. (a) Draw the block diagram of a DSO and explain the working. Compare between ASO and DSO performance.

Or

(b) Explain four important features of virtual instrumentation.

PART C — (1 × 15 = 15 marks)

16. (a) Design a R-2R converter circuit by assuming suitable specifications.

Or

(b) An ac bridge has the following constants : arm AB, R=1K Ω in parallel with C=0.159 μf; BC, R = 1 K Ω, CD, R = 500 Ω; DA, C = 0.636 μf in series with an unknown resistance. Find the frequency for which this bridge is balanced and determine the value of resistance in arm DA to produce this balance.

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Question Paper Code : 50535

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Fourth Semester

Electrical and Electronics Engineering

EE 8403 – MEASUREMENTS AND INSTRUMENTATION

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define Sensitivity of Measurement.

2. How is median calculated?

3. Differentiate Single and Three phase wattmeters.

4. Enumerate the significance of magnetic measurements in view of its applications.

5. Define Electrostatic interference

6. List the grounding techniques.

7. What are the main parts in CRO?

8. What is Digital sampling oscilloscope?

9. Define Hall effect.

10. Compare and contrast Active and Passive transducers.

PART B — (5 × 13 = 65 marks)

11. (a) Explain the working principle of Dual slope Digital Voltmeter.

Or

(b) Enlist and Explain the different types of errors associated with measurements.

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12. (a) Describe how the iron loss is measured and the significance of B-H Curve.

Or

(b) Explain the working principle of instrument transformer with neat sketch.

13. (a) Explain the operation of Anderson Bridge to find unknown inductance.

Or

(b) Describe the functioning of Kelvin bridge and its extension.

14. (a) Sketch a block diagram showing the main components in a digital storage oscilloscope and explain the mode of operation of the instrument.

Or

(b) Describe the significance of Data loggers in Display device applications.

15. (a) Explain the working principle of Piezoelectric transducer with neat sketch.

Or

(b) Describe the elements of Data acquisition system with neat sketch.

PART C — (1 × 15 = 15 marks)

16. (a) Draw and describe the two — wattmeter method for star and delta connected system and discuss the effect of power factor on wattmeter readings.

Or

(b) Identify and describe the instrument used for measuring frequency and phase.

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Question Paper Code : 50768

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Fourth Semester

Instrumentation and Control Engineering

IC 8451 — CONTROL SYSTEMS

(Common to Electrical and Electronics Engineering/
Electronics and Instrumentation Engineering)

(Regulations 2017)

Time : Three hours Maximum : 100 marks

(Provide Semilog sheet, Polar graph and ordinary graph sheet)

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Write Mason's gain formula and mention the advantages.

2. What are the advantages of a closed loop control system over open loop system?

3. The damping ratio and the undamped natural frequency of a second order system are 0.5 and 5 respectively. Calculate the resonant frequency.

4. Differentiate transient and steady state response.

5. Mention the frequency domain specifications and define resonant peak and bandwidth.

6. Draw the electrical equivalent of lag- lead compensator and write the transfer function

7. Define stability.

8. State Nyquist stability Criterion.

9. What are the advantages of state space modeling using physical variable?

10. List the important properties of a state transition matrix.

PART B — (5 × 13 = 65 marks)

11. (a) Obtain the transfer function $\frac{C(S)}{R(S)}$ for the block diagram shown in figure 11 a. using block diagram reduction technique.

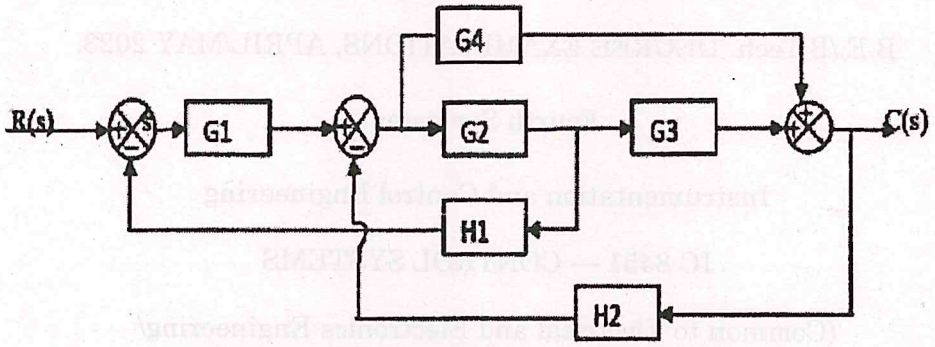

Figure 11a

Or

(b) Illustrate Mason's formula to derive the transfer function of a given signal flow graph in figure 11b.

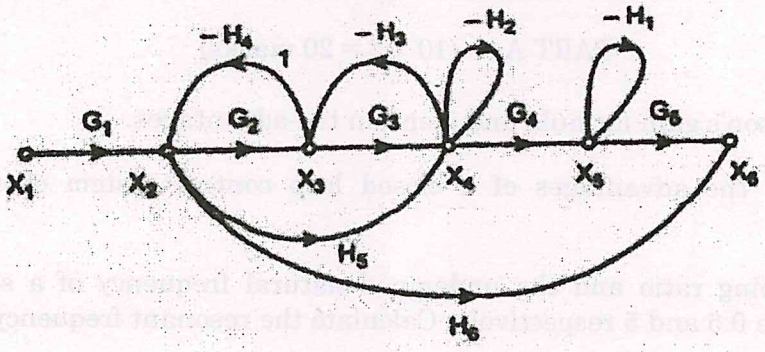

Figure 11b

12. (a) Estimate the step response of a second order under damped system. Use standard notations.

Or

(b) The unity feedback system characterized by open loop transfer function $G(S) = \frac{K}{S(S+10)}$ Evaluate the gain K such that damping ratio will be 0.5 and find time domain specifications for a unit step input.

13. (a) A unity feedback control system has $G(S)=\dfrac{15}{(S+1)(S+3)(S+6)}$. Draw the Bode plot.

Or

(b) Design a lead compensator to meet the following specifications for a unity feedback system with open loop transfer function $G(S)=\dfrac{K}{S(S+1)}$. It is desired to have the velocity error constant $K_v=12\sec^{-1}$ and phase margin is 40°.

14. (a) Consider the sixth order system with the characteristic equation $S^6+2S^5+8S^4+12S^3+20S^2+16S+16=0$. Use Routh-Hurwitz criterion to examine the stability of the system and comment on location of the roots of the characteristics equation.

Or

(b) The open loop transfer function of a unity feedback system is given by, $G(S)=\dfrac{K}{S(S+1)+(S+5)}$ where $K>0$. Apply Nyquist stability criterion to determine range of K over which the closed loop system will be stable.

15. (a) Solve the state equation for the system as given in below to obtain the time response $x(t)$ for a unit step input

$$X=\begin{bmatrix}0 & 1\\ -2 & -3\end{bmatrix}X+\begin{bmatrix}0\\1\end{bmatrix}u;\ Y=\begin{bmatrix}1 & 0\end{bmatrix}X$$. Assume zero initial conditions.

Or

(b) Test the controllability and observability of the system by any one method whose state space representation is given as,

$$\begin{bmatrix}x_1\\x_2\\x_3\end{bmatrix}=\begin{bmatrix}0 & 1 & 0\\0 & 0 & 1\\0 & 0 & 0\end{bmatrix}\begin{bmatrix}x_1\\x_2\\x_3\end{bmatrix}+\begin{bmatrix}0\\0\\1\end{bmatrix}u(t);\ y(t)=\begin{bmatrix}1 & 0 & 0\end{bmatrix}\begin{bmatrix}x_1\\x_2\\x_3\end{bmatrix}+o[u]$$

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PART C — (1 × 15 = 15 marks)

16. (a) Develop the differential equations governing the mechanical translational system shown in figure 16a and determine the transfer function $\frac{V_1(S)}{F(S)}$

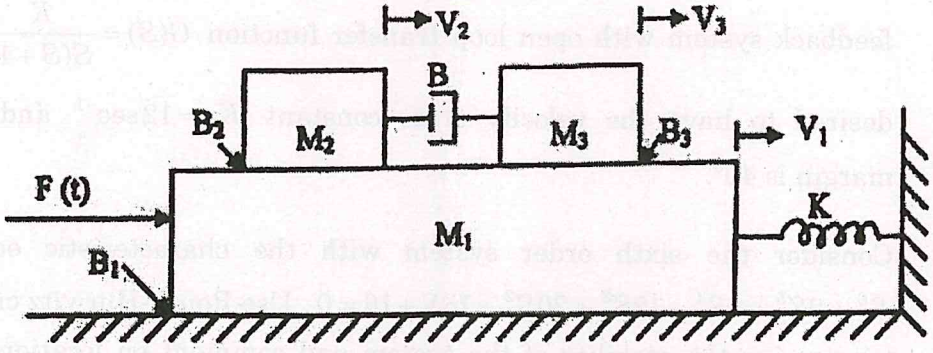

Figure 16a

Or

(b) Write the differential equations governing the mechanical system as shown it figure 16b. Draw force-voltage and force-current electrical analogous circuits.

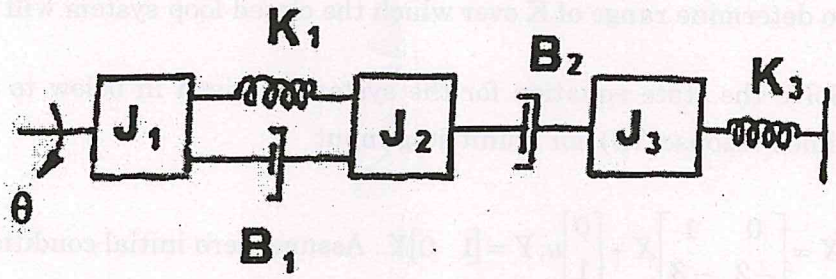

Figure 16b

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Question Paper Code : 30150

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023

Fourth Semester

Electrical and Electronics Engineering

EE 3401 – TRANSMISSION AND DISTRIBUTION

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Point out the advantages of bundled conductor.

2. Define proximity effect.

3. Write ABCD constants of medium T network.

4. Define Ferranti effect.

5. Give any two factors that affect sag in an overhead line.

6. What are the types of line supports used in transmission and distribution systems?

7. Compare overhead lines and underground cables.

8. Write the expression to determine capacitance of a single core cable.

9. How does AC distribution differ from DC distribution?

10. What are the advantages of FACTS controllers?

PART B — (5 × 13 = 65 marks)

11. (a) Derive the expression for inductance of three phase line with unsymmetrical spacing.

Or

(b) A 220kV, 50Hz, 200km long three phase line has its conductors on the corners of a triangle with sides 6m, 6m and 12m. The conductor radius is 1.81 cm. Find the capacitance per phase per km. Capacitive reactance per phase, Charging current and Charging Mega volt-amperes.

12. (a) Using rigorous method, derive expression for sending end voltage and current for a long transmission line.

Or

(b) Explain various steps involved in receiving end power circle diagram with neat sketches.

13. (a) Derive an expression for sag of a line supported between two supports of the same height. Also Explain the effect of ice and wind loading.

Or

(b) (i) Define string efficiency of suspension insulator string. List the methods to improve it. (5)

(ii) Each line of 3 phase system is suspended by the string of 3 identical insulators of self-capacitance 'C' F. The shunt capacitance of connecting metal work of each insulator is 0.2 C to earth and 0.1 C to line. Calculate the string efficiency of the system if a guard ring increases the capacitance to the line of metal work of the lowest insulator to 0.3C. (8)

14. (a) With neat diagram, explain the various methods of grading of underground cables.

Or

(b) Derive an expression for the insulation resistance, capacitance and the electrostatic stress of a single core cable.

15. (a) What are the different types of bus bar arrangements used in substations? Illustrate your answer with suitable diagrams.

Or

(b) Discuss the advantages of HVDC transmission over HVAC transmission in detail.

PART C — (1 × 15 = 15 marks)

16. (a) A cable is graded with three dielectrics of permittivity's 4, 3 and 2 respectively. The maximum permissible potential gradient is same and equals to 30kv/cm. The core diameter is 1.5cm and internal sheath diameter is 5.5cm. Calculate the working voltage.

Or

(b) A 11kv 3 phase underground feeder, 2km long uses three single core cables. The diameter of each conductor is 28mm and an insulation thickness of 4.4 mm and the relative permittivity of 4. Determine (i) Capacitance of the cable per phase (ii) charging current per phase (iii) total charging KVAR (iv) Dielectric loss per phase if the power factor of unloaded cable is 0.04.

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Question Paper Code : 50536

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Fourth Semester

Electrical and Electronics Engineering

EE 8451 – LINEAR INTEGRATED CIRCUITS AND APPLICATIONS

(Common to : Electronics and Instrumentation Engineering, Instrumentation and Control Engineering)

(Regulations – 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Is it true that NPN Transistors are preferred over PNP for IC Technology? Justify your answer.

2. Mention the advantages of Thin Film Resistors.

3. Compute the slew rate if a 100 pF capacitor has a maximum charging current of 150 μA.

4. List the ideal characteristics of an Operational Amplifier.

5. Give any four applications of comparators.

6. Draw the circuit diagram of an Integrator using OP-AMP and give its output equation.

7. In a Monostable Multivibrator using IC 555 Timer, the value of $R_A = 5.6\ \Omega$ *and* $C = 0.068\ \mu F$. Calculate the Pulse width period (T).

8. Define the term "Capture Range" in PLL.

9. Differentiate Load Regulation and Line Regulation.

10. Switching Regulators are better than Series Regulators in terms of efficiency. Is this true? Justify your answer.

PART B — (5 × 13 = 65 marks)

11. (a) With neat diagrams, explain the various steps involved in the process of IC Fabrication.

Or

(b) Explain in detail about photolithography process with neat diagram.

12. (a) Draw the circuits for Inverting and Non-inverting amplifiers using OP-AMP and derive the equation for the gain.

Or

(b) Discuss in detail about the DC and AC characteristics of OP-AMP.

13. (a) Design a RC Phase Shift Oscillator to generate a waveform of 1 kHz.

Or

(b) Illustrate the design of the second order high pass filter with its frequency response.

14. (a) Explain the working of Voltage Controlled Oscillator (VCO) and derive its output frequency.

Or

(b) Discuss the various applications of Phase Locked Loop.

15. (a) Explain in detail the working principle of switched mode power supply with necessary diagrams and waveforms.

Or

(b) Explain as to how AD623 Instrumentation Amplifier is used for Load Cell Weight measurement.

PART C — (1 × 15 = 15 marks)

16. (a) Design a monostable multivibrator using op-amp and obtain expression for pulse width T.

Or

(b) With a necessary circuit diagrams and waveforms, explain as to how a IC 555 Timer is used to design a Free Running Oscillator.

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BEE

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Question Paper Code : 30154

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Fourth Semester

Electrical and Electronics Engineering

EE 3405 – ELECTRICAL MACHINES – II

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define Winding Factor in synchronous generator.

2. Give the applications of salient pole and non-salient pole alternators.

3. Define "Pull in Torque" in synchronous Motor.

4. What is the use of damper winding in synchronous motor?

5. Define "slip" in Induction motor.

6. Why rotor of a squirrel cage Induction motor is skewed?

7. What is meant by V/f control in induction motor?

8. What is the meant by Plugging in IM?

9. Why the single phase IM is not self starting?

10. Define the principle of magnetic Levitation.

PART B — (5 × 13 = 65 marks)

11. (a) Derive the generated EMF expression for an alternator. What will be the rms value of emf induced per phase in 3-phase, 6-pole, star-connected alternator having a stator with 90 slots and 8 conductors per slot? The flux per pole is 0.4mWb and it runs at a speed of 1000 rpm. Assume full-pitched coils and sinusoidal flux distribution.

Or

(b) How the regulation of an alternator is found using EMF method? A single-phase, 500 V, 50 Hz alternator produces a short-circuit current of 170 A and an open circuit emf of 425 V when a field current of 15A passes through its field winding. If its armature has an effective resistance of 0.2 ohm, determine its full-load regulation at unity pf and at 0.8 pf lagging using EMF method.

12. (a) Discuss the starting methods of synchronous motor.

Or

(b) Describe the method of finding out the "V and inverted V" curve with neat sketch.

13. (a) Explain the construction, working principle and parts of three phase induction motor.

Or

(b) Discuss how the circle diagram is constructed through the No load and blocked rotor tests in three phase Induction motor.

14. (a) Explain the Rotor resistance starter in 3 phase Induction motor with neat sketch.

Or

(b) Briefly discuss the operation of Static Kramer's and Static Scherbius drives with neat sketch.

15. (a) Discuss the concept of Double field revolving theory with neat sketch.

Or

(b) Discuss the operation of Linear induction motor with neat sketch.

PART C — (1 × 15 = 15 marks)

16. (a) The rotor resistance and stand-still reactance per phase of a 3-phase, 4-pole, 50 Hz induction motor is 0.2 ohm and 2 ohm respectively. The rotor is connected in star and emf induced between the slip rings at start is 80 V. If at full-load, motor is running at a speed of 1440 rpm, calculate (i) the slip (ii) rotor induced emf per phase (iii) the rotor current and power factor under running condition and (iv) rotor current and p.f. at standstill when the slip rings are short circuited.

Or

(b) The impedance of the rotor circuit at standstill of a 1000 HP, 3-phase, 16-pole induction motor is (0.02 + j0.15) ohm. It develops full-load torque at 360 rpm. What will be.

(i) The ratio of maximum to full load torque

(ii) The speed at maximum torque

(iii) The rotor resistance to be added to get maximum starting torque.

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Question Paper Code : 30151

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Fourth Semester

Electrical and Electronics Engineering

EE 3402 — LINEAR INTEGRATED CIRCUITS

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Mention the properties of silicon di-oxide.

2. What are the advantages of thin film resistor over diffused resistors?

3. Define Thermal drift.

4. Define Slew Rate.

5. What is a sample and hold circuit?

6. Define "Resolution" in ADC/DAC.

7. List out the applications of 555 timer in Astable mode.

8. Mention the types of phase detector in PLL.

9. List out the negative voltage regulator ICs.

10. Define "line regulation" in IC voltage regulator.

PART B — (5 × 13 = 65 marks)

11. (a) Explain the epitaxial growth, masking, etching and diffusion techniques in IC fabrication process with neat sketch.

Or

(b) Explain the different types of IC capacitor fabrication technique.

12. (a) With neat sketch explain the adder-subtractor combinational circuit with neat sketch.

Or

(b) Describe the working of differentiator and integrator. Draw the outputs for the inputs, sine and square waves.

13. (a) Explain the working of a second order active low pass filter with neat sketch and also draw its frequency response curve.

Or

(b) Explain the R-2R ladder and inverted R-2R ladder DACs.

14. (a) Briefly discuss the working of Phase Locked Loops(PLL).

Or

(b) With neat sketch, describe the working of a Astable multivibrator using 555 timer.

15. (a) Discuss the working of AD623 Instrumentation amplifier with neat sketch and also explain how it is used in the weight measurement.

Or

(b) Discuss the operation of Switched Mode Power Supply with neat sketch.

PART C — (1 × 15 = 15 marks)

16. (a) Design a circuit using Op-amp, which implements the following

(i) $V_o = 5 + (10 \sin \omega t)$ when $V_i = 10 \sin \omega t$

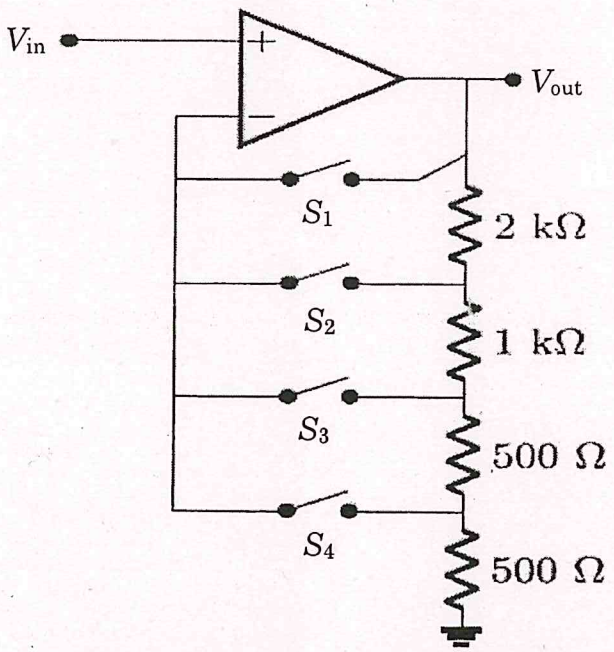
(ii) Output is clipped above 5V when the input is $10 \sin \omega t$.

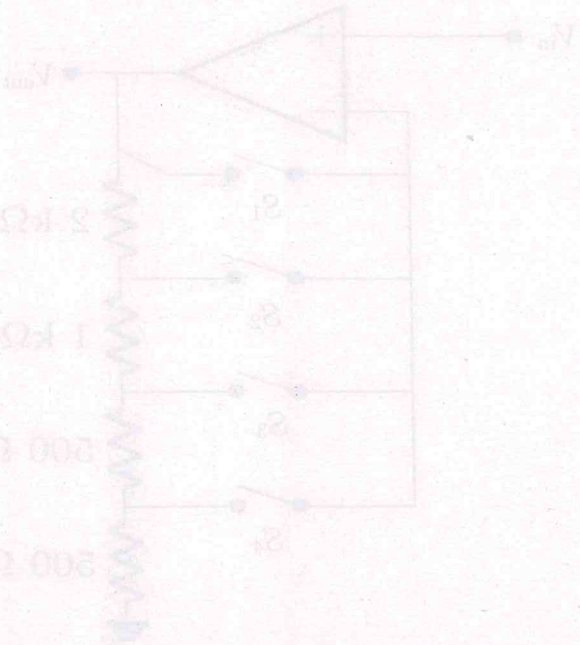
(iii) Output is clipped below 6V when the input is $15 \sin \omega t$.

(iv) $V_o = 8V_1 - 7V_2$

Or

(b) Find the gain of the programmable gains amplifier shown in the following figure when S_1 alone is closed, S_2 alone is closed, S_3 alone is closed, S_4 alone is closed and S_1 and S_3 is closed.





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Question Paper Code : 30153

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Fourth Semester

Electrical and Electronics Engineering

EE 3404 – MICROPROCESSOR AND MICROCONTROLLER

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Expand (a) PC (b) SP (c) ALU (d) ALE

2. Find the maximum external memory that shall be interfaced with 8085 which has 16-bit address lines.

3. Why subroutine is called so?

4. State any two applications of look up table.

5. Discuss the capabilities of 8251 USART chip.

6. Name the registers used to program and control the operation of IC 8259PIC.

7. Mention the role of stack pointer in using stack.

8. Define IDE.

9. Compare CISC with RISC.

10. List any four special features of PIC controller.

PART B — (5 × 13 = 65 marks)

11. (a) Explain the software and hardware interrupts available in 8085 along with their vector addresses.

Or

(b) Draw and explain the timing diagram of (i) Memory read machine cycle and (ii) Memory write cycle of 8085.

12. (a) List and define the addressing modes supported by 8085 microprocessor with examples.

Or

(b) State the data manipulation instructions in 8051 microprocessor and mention their functions.

13. (a) With neat diagram, Explain the architecture and interfacing of 8255 PPI.

Or

(b) Draw the internal block diagram of 8279 keyboard display controller and explain its features.

14. (a) Explain the various operating modes of 8051 timer and special function registers associated with timer/counter.

Or

(b) Explain the structure of port 0 and port 3 of 8051 microcontroller.

15. (a) Draw the architecture and list the major functional elements of PIC microcontroller.

Or

(b) Mention the instructions of PIC microcontroller and their functions.

PART C — (1 × 15 = 15 marks)

16. (a) For an industrial application, it is required to generate sinusoidal waveform. Interface D/A Converter with 8085 and develop an algorithm and Assembly Language Program to generate the sinusoidal waveform continuously.

Or

(b) A simple robot arm is created using stepper motor and controlled by 8051 microcontroller. Draw the interfacing diagram and develop algorithm and program to run the stepper motor in clockwise direction for 60 degrees. Assume suitable step angle.

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Question Paper Code : 50533

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Fourth Semester

Electrical and Electronics Engineering

EE 8401 – ELECTRICAL MACHINES – II

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the conditions required for parallel operation of alternators?

2. Define regulation.

3. What is the role of damper winding?

4. Why synchronous motor is not self-starting?

5. Compare squirrel cage and slip ring induction motor.

6. Write the condition for getting maximum torque from a three phase induction motor.

7. What are the speed control methods of three phase induction motor?

8. What is the need for starters for a three phase induction motor?

9. What are the applications of shaded pole induction motor?

10. Why single phase induction motor is not a self-starting?

PART B — (5 × 13 = 65 marks)

11. (a) In a 2000 V. single-phase synchronous generator, a full-load current of 100 A is produced on short-circuit by a field excitation of 2.5 A; an emf of 500 V is produced on open-circuit by the same excitation. The armature resistance is 0.8 Ω. Determine the voltage regulation when the generator is delivering a current of 100 A at (13)

(i) unity power factor,

(ii) 0.71 power factor lagging; and

(iii) 0.8 power factor leading. (4+5+4)

Or

(b) The no-load test performed on a 1000 kVA, 3000 V, 50Hz, three-phase star connected alternator gave the following readings:

I_f (A)	15	30	50	75	90	120	150
V/ph (V)	354	690	1200	1675	1900	2130	2200

The effective armature resistance is 0.25 ohms.

When short-circuit test was conducted, a field current of 50 A was required to circulate the full-load current. Determine the percentage voltage regulation of the alternator on full-load at 0.8 lagging power factor by mmf method. (13)

12. (a) An industrial plant has a load of 800 kW at of power factor of 0.8 lagging. It is desired to install a synchronous motor to deliver a load of 200 kW and also serve as a synchronous condenser to improve the overall power factor of the plant to 0.92. Determine the kVA rating of the synchronous motor and its power factor. Assume that the synchronous motor has an efficiency of 90 per cent. (13)

Or

(b) Explain 'V' and inverted 'V' curves. (13)

13. (a) An 8-pole, 50 Hz induction motor has a full-load slip of 2.5 per cent and a maximum torque of twice the full-load torque. At what value of slip does the maximum torque occur? (13)

Or

(b) The power input to a 500 V, 50 Hz, 6-pole, 3-phase induction motor running at 975 rpm is 40 kW. The stator losses are 1 kW and friction and windage losses are 2 kW. Calculate (13)

(i) the slip,

(ii) the rotor copper loss;

(iii) the output horse-power;

(iv) the efficiency.

14. (a) The rotor of a 4-pole, 50 Hz, 3-phase, slip-ring induction motor has a resistance of 0.25 Ω per phase and runs at 1440 rpm on full load. Calculate the external resistance per phase which must be added to lower the speed to 1200 rpm, the torque remaining constant in both the cases. (13)

Or

(b) Explain v/f control and slip power recovery scheme. (6+7)

15. (a) Explain the working of stepper motor and linear induction motor. (7+6)

Or

(b) Explain the various starting mechanisms for single phase induction motor. (13)

PART C — (1 × 15 = 15 marks)

16. (a) A 400 V, 50 Hz, 6 pole, 3-phase induction motor has rotor resistance of 0.03 ohm and standstill rotor reactance per phase of 0.4 ohm. Calculate the speed of the motor when developing maximum torque and also calculate the ratio of maximum torque to full-load torque. The full-load speed is 960 rpm. (15)

Or

(b) A 4-pole 25 kVA, 400 V, 50 Hz, three-phase star connected synchronous generator gave the following test data. (15)

Field current, I_f (A)	2	4	6	8	10	12	14	16
No-load terminal voltage (V)	138	277	355	415	468	502	533	554
Zero power factor load terminal voltage (V)			0	108	218	295	346	415

Determine the voltage regulation at full-load 0.8 power factor lagging by Potier triangle method. The armature resistance is 0.2 ohms.

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Question Paper Code : 50534

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Fourth Semester

Electrical and Electronics Engineering

EE 8402 – TRANSMISSION AND DISTRIBUTION

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is the effect of bundled conductors on line inductance?

2. What is proximity effect?

3. For a lossless transmission line $L = 0.001\,mH/m, C = 90pF/m$ and frequency = 50 Hz. Find the value of attenuation constant.

4. What are the factors which affect corona loss?

5. What is the effect of wind on sag?

6. What are the important factory tests conducted on insulators?

7. Define capacitance grading of cables.

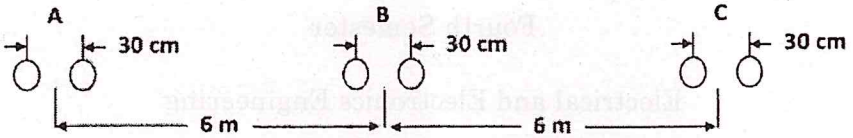
8. What are oil filled cables?

9. What is Kelvin's law for most economic size of the line conductor?

10. What is the role of the load power factor in the AC distribution system?

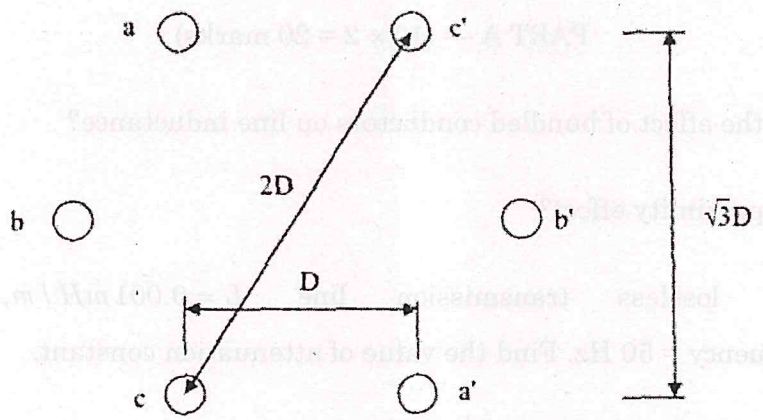
PART B — (5 × 13 = 65 marks)

11. (a) Calculate the inductance per km per phase for a 3-phase, 50 Hz, bundled conductor line shown in Figure. Each subconductor has a diameter of 25 mm and subconductor spacing is 0.3 m. Assume that each phase group shares total current and charge equally and the line is completely transposed.



Or

(b) A 3-phase double circuit line has the conductors at the vertices of a hexagon as shown in Figure. Find the formula for calculating capacitance per phase per km in terms of side D and conductor radius r.



12. (a) A 3-phase, 50 Hz, 16 km long overhead line supplies 1000 kW at 11kV, 0.8 p.f. lagging. The line resistance is 0.03 Ω per phase per km and line inductance is 0.7 mH per phase per km. Calculate the sending end voltage, voltage regulation and efficiency of transmission.

Or

(b) Draw the phasor diagram for a nominal π circuit and derive the expressions for sending end voltage and current in terms of receiving end voltage and current.

13. (a) An overhead line has a span of 336 m. The line is supported at a water crossing, from two towers whose heights are 33.6 m and 29 m above water level. The weight of conductor is 8.33 kg/m and tension in the conductor is not to exceed 33400 N. Find clearance between the lowest point on the conductor and water and also find the horizontal distance of this point from the lower support.

Or

(b) An insulator string for 66 kV line has 4 discs. The shunt capacitance between each joint and metal work is 10% of the capacitance of each disc. Find the voltage across the different discs and string efficiency.

14. (a) Draw the cross-section of a 3-core belted cable. Discuss the function of each part.

Or

(b) Derive a relation between the conductor radius and inside sheath radius of a single core cable so that the electric stress of the conductor surface may be minimum.

15. (a) Discuss about the different techniques of voltage control.

Or

(b) Discuss the technical and economic advantages of HVDC systems over HVAC systems.

PART C — (1 × 15 = 15 marks)

16. (a) A 3-phase overhead line has a series impedance of 10 + j30 ohms per phase. For receiving and sending end voltages of 132 kV and 140 kV respectively draw the receiving end power circle and determine the maximum real power which the line can supply and the load power factor for drawing this maximum power.

Or

(b) Two conductors of a DC distributor cable AB 1000m long have a total resistance of 0.1 Ω. The ends A and B are fed at 240 V. The cable is uniformly loaded at 0.5 A per metre length and has concentrated loads of 120 A, 60 A, 100 A and 40 A at points distant 200 m, 400 m, 700 m and 900 m respectively from the end A. Calculate the point of minimum potential and the value of minimum potential.

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Question Paper Code : 50538

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Fifth Semester

Electrical and Electronics Engineering

EE 8501 – POWER SYSTEM ANALYSIS

(Regulations 2017)

Time : Three hours Maximum : 100 marks

(Codes / Tables / Charts to be permitted, if any, may be indicated)

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define bus impedance matrix.
2. List the advantages of per unit computations.
3. What is P-Q bus in power flow analysis?
4. What do you mean by flat voltage start?
5. What is the need for short circuit analysis?
6. Define bolted fault.
7. What are symmetrical components?
8. List the various types of unsymmetrical faults.
9. Define power angle.
10. State equal area criterion.

PART B — (5 × 13 = 65 marks)

11. (a) Obtain PU impedance diagram of the power system of figure. Choose base quantities as 15 MVA and 33 KV.

Generator: 30 MVA, 10.5KV, X"= 1.6 ohms. Transformers T_1 and T_2: 15 MVA, 33/11 KV, X = 15 ohms referred to HV.

Transmission line: 20 ohms / phase. Load: 40 MW, 6.6 KV, 0.85 lagging p.f.

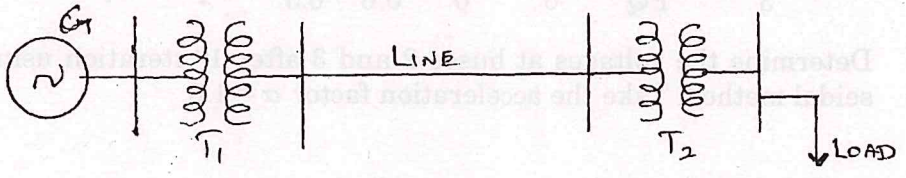

Fig. 11 (a)

Or

(b) Form Y-bus of the system shown in Fig. 11(b) using singular transformation method. The impedance data is given in the table. Take bus 1 as reference node.

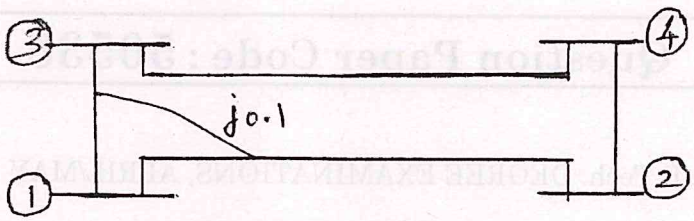

Fig. 11(b)

Element No.	Self		Mutual	
	Bus Code	Impedance (p.u.)	Bus Code	Impedance (p.u.)
1	1-2	0.5		
2	1-3	0.6	1-2	0.1
3	3-4	0.4		
4	2-4	0.3		

12. (a) Prepare the load flow algorithm using gauss seidal method with the flowchart and discuss the advantages of the method.

Or

(b) A three bus power system is shown in Fig. 12(b) and its data's are given in the table.

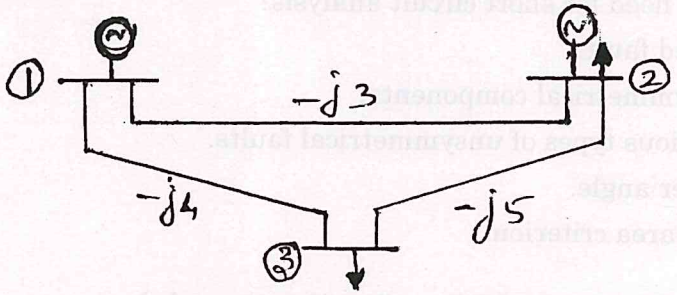

Fig. 12(b)

Bus No.	Type	Generation		Load		Bus Voltage	
		P_G	Q_G	P_L	Q_L	V	δ
1	Stack	-	-	-	-	1.02	0
2	PQ	0.25	0.15	0.5	0.25	-	-
3	PQ	0	0	0.6	0.3	-	-

Determine the voltages at buses 2 and 3 after 1st iteration using gauss-seidal method. Take the acceleration factor $\alpha = 1.6$.

13. (a) Explain the step by step procedure to find the fault current of three phase symmetrical fault current by using Thevenin's theorem.

Or

(b) For the radial network shown in Fig. 13 (b), a three phase fault occurs at point F. Examine the fault current.

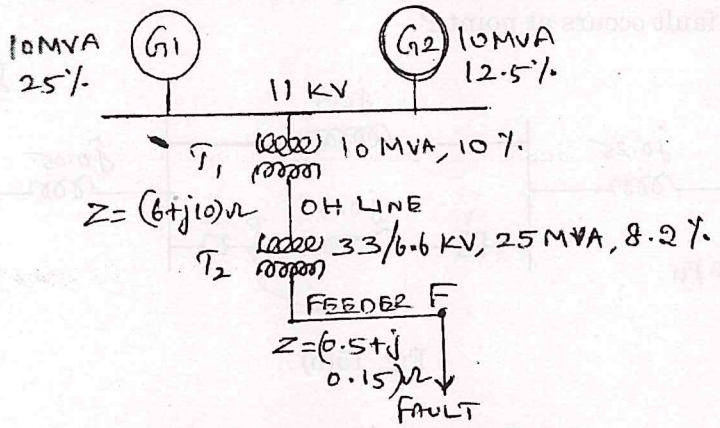

Fig. 13 (b)

14. (a) A single line to ground fault occurs at bus 4 of the system shown in Fig. 14(a). (i) Draw the equivalent networks (ii) Compute fault current.

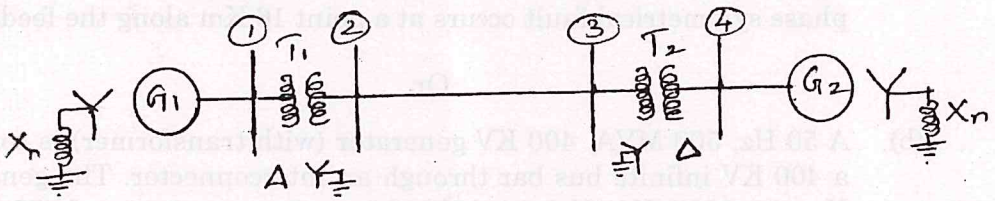

Fig. 14(a)

G_1, G_2: 100 MVA, 20 kV, X'=X" = 20%, X_0 = 4%, X_n = 5%

T_1, T_2: 100 MVA, 20/345 kV, X_{leak} = 8% on 100 MVA

Tr. Line: X' = X" = 15%, X = 50% on a base of 100 MVA, 20kV.

Or

(b) Derive the expression for fault current for a double line to ground fault in an unloaded generator in terms of symmetrical components.

15. (a) Describe the equal area criterion for transient stability analysis of a system.

Or

(b) Given the system of Fig. 15(b) shown below where a three phase fault is applied at a point P as shown. Examine the critical clearing angle for clearing the fault with simultaneous opening of the breakers 1 and 2. The reactance values of various components are indicated in the diagram. The generator is delivering 1.0 p.u. power at the instant preceding the fault. The fault occurs at point P.

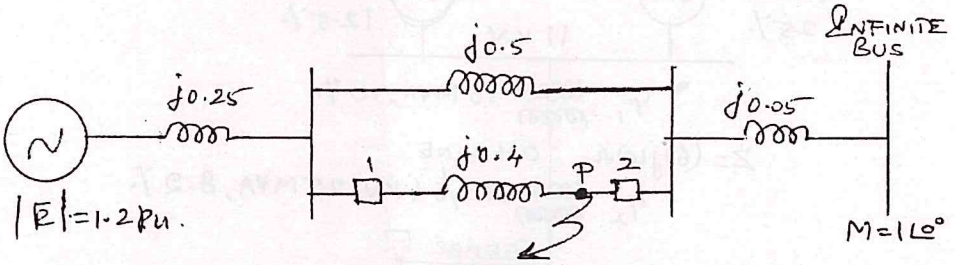

Fig. 15(b)

PART C — (1 × 15 = 15 marks)

16. (a) A 3-phase 6 MVA, 6.6 KV alternator with a reactance of 12% is connected to a feeder of series impedance (0.10+j0.5) ohm/phase/Km through a step up transformer. The transformer is rated at 3 MVA, 6.6 KV/33KV and has a reactance of 7%. Determine the fault current supplied by the generator operating under no load with a voltage of 6.9 KV when a three phase symmetrical fault occurs at a point 16 Km along the feeder.

Or

(b) A 50 Hz, 500 MVA, 400 KV generator (with transformer) is connected to a 400 KV infinite bus bar through an interconnector. The generator has H = 2.5 MJ/MVA. Voltage behind transient reactance of 450 KV and is loaded 460 MW. The transfer reactances between generator and bus bar under various conditions are: Prefault 0.5 p.u., During Fault 1.0 p.u., Post fault 0.75 p.u. Calculate the swing curve using intervals of 0.05 sec and assuming that the fault is cleared at 0.15 sec.

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Question Paper Code : 50540

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Fifth Semester

Electrical and Electronics Engineering

EE 8552 — POWER ELECTRONICS

(Common to : Mechatronics Engineering)

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define ODF in a power BJT.

2. *"Snubber circuit for an SCR should primarily consist of capacitor only But, in actual practice, a resistor is used in series with the capacitor"*- Interpret.

3. What is the relation between α, β and γ in single-phase fully controlled rectifier when operating with RL load?

4. What are the influences of pulse number of phase-controlled rectifiers on their output voltage ripple content?

5. What is a time ratio control?

6. A chopper is operating at a frequency of 2kHz on a 230V DC input, if the load voltage is 150V, calculate the conduction and non-conduction periods of thyristor in each cycle.

7. Mention the types of UPS.

8. What is meant by overmodulation in SPWM? Mention its necessity.

9. A single-phase voltage controller has input voltage of 230V, 50Hz and a load of R = 15 Ω. For 6 cycles ON and 4 cycles OFF, determine the rms value of output voltage

10. A three phase six-pulse, 50 kVA, 415 V cycloconverter is operating at a firing angle of 450 and supplying load of 0.8 power factor. Determine input current to the converters.

PART B — (5 × 13 = 65 marks)

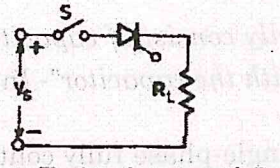
11. (a) (i) Discuss the basic structure and working of power IGBT. (6)

(ii) Draw the two-transistor model of SCR and derive an expression for anode current. (7)

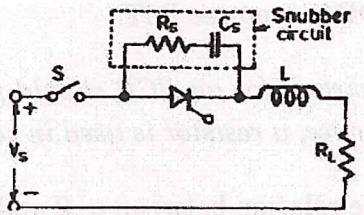
Or

(b) (i) Explain in details the different SCR commutation methods. (9)

(ii) The figure shown beneath shows a thyristor controlling the power in a load resistance R_L. The supply voltage is 240 V dc and the specified limits for di/dt and dv/dt for the SCR are 50 A/μs and 300V/μs respectively. Determine the values of the di/dt inductance and the snubber circuit parameters R_S and C_S. (4)



(a) Thyristor in series with R_L



(b) Thyristor protection with L and R_s, C_s

12. (a) Explain the single phase fully controlled rectifier while feeding a load current of severe discontinuity. (13)

Or

(b) (i) Explain the effect of source inductance in the performance of the single-phase fully controlled rectifier. (9)

(ii) Discuss the involvement of phase-controlled rectifiers in light dimmer application. (4)

13. (a) (i) With help of circuit diagram and waveforms explain the principle of working of boost converter. (8)

(ii) For a class chopper working with resistive load of R ohms, input voltage of V_{dc} and duty cycle α, express the following variables as functions of R, V_{dc} and α. (1 × 5 = 5)

(1) Average output voltage and *current*

(2) Output current at the commutation

(3) Average and RMS freewheeling diode currents

(4) RMS value of output voltage

(5) Average and RMS load currents

Or

(b) (i) Describe the working of L-type ZCS resonant dc to dc converter. (5)

(ii) Explain the working of class A chopper and arrive the output voltage relation. Also perform the steady state time domain analysis and obtain the output current equation. (8)

14. (a) (i) Draw the circuit diagram of 1ϕ auto sequential commutated current source inverter and explain its operation with equivalent circuits for different modes and necessary waveforms. (10)

(ii) Write short notes on the principle of UPS. (3)

Or

(b) Explain the principle of space vector PWM applied to three phase VSI using the space vector diagram. (13)

15. (a) Explain the basic principle of operation of a three-phase to single phase cycloconverter with circuit diagram and waveforms. Identify and mark the durations of rectification and inversion modes of converter groups for the *assumed load* angle. Obtain the fundamental rms value of output voltage/phase for an m-pulse cycloconverter. (13)

Or

(b) (i) With the suitable circuit, discuss about the matrix converter. (7)

(ii) A $1-\Phi$ AC voltage controller *has, a* resistive load of R = 10 Ω and input voltage is V_S = 120 V, 60 Hz the delay angle of thyristor T_1 is $\alpha = \frac{\pi}{2}$. Determine, (6)

(1) the rms value of output voltage V_0

(2) the input PF and

(3) the average input current.

PART C — (1 × 15 = 15 marks)

16. (a) (i) The buck regulator has an input range of V_S = 12 V. The regulated average output voltage is V_a = 5 V at R =500 Ω and the peak to peak output ripple voltage is 20 mV. The switching frequency is 25 kHz if the peak to peak ripple current of inductor is limited to 0.8 A determine (10)

(1) The duty cycle, K

(2) The filter inductance, L

(3) The filter capacitance, C and the critical value of L and C.

(ii) A single phase two pulse bridge converter feeds power to RLE load with R = 10 Ω, L = 10 mH E = 100 V, ac voltage is 250V, 50 Hz for continuous conduction. Find the average value of load current for a firing angle of 50°. In case one of the SCR's gets open circuited, find the new value of average load current assuming the output current as continuous. (5)

Or

(b) (i) A three-phase to single-phase cycloconverter employs a six-pulse bridge circuit and fed from 400V, 50Hz supply through a delta/star connected transformer whose per phase turns ratio 3:1. For a output frequency of 2Hz, the load reactance is $\omega_o L$ = 3 Ω. The load resistance is 4 Ω. The commutation overlap and thyristor turn-off limit the firing angle in the inversion mode to 165°. Compute (7)

(1) Peak value of rms output voltage

(2) rms output current

(3) output power

(ii) For a single-phase voltage controller feeding a resistive load, show that power factor is given by the expression $\left[\frac{1}{\pi}\left\{(\pi-\alpha)+\frac{1}{2}\sin 2\alpha\right\}\right]^{1/2}$. (8)

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Question Paper Code : 50539

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Fifth Semester

Electrical and Electronic Engineering

EE 8551 – MICROPROCESSORS AND MICROCONTROLLERS

(Common to: Electronics and Instrumentation Engineering/Instrumentation and Control Engineering)

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define tristate logic.

2. Write the largest hexadecimal number that can appear on 8085 data bus. Also, specify the number of memory locations that can be addressed using 8085 address lines.

3. Give an example for a two-byte instruction and a three-byte instruction.

4. Find the result stored in accumulator after the execution of the following assembly program:

```
MVI A, FFH

MVI B, 8DH

SUB B

ANI 0F

STA 2550H

HLT
```

5. What are the criteria for choosing a microcontroller?

6. Show the status of auxiliary carry and parity flags after the addition of 38H and 2FH in the following instructions:

   MOV A, #38H

   ADD A, #2FH

7. Compare two key lock out mode of 8279 with N-key roll over mode.

8. Draw the control word format for I/O mode of 8255 programmable peripheral interface.

9. List any two characteristics of the architecture followed by 8051 microcontroller.

10. What happens when the 8051 microcontroller instruction "MOVC A, @ A+DPTR" is executed?

PART B — (5 × 13 = 65 marks)

11. (a) With a functional block diagram, briefly discuss the architecture of the 8085 microprocessor.

Or

(b) (i) Illustrate the steps involved in the development of an assembly language program for an application. (7)

(ii) Discuss how the 8085 microprocessor write into a register of a memory chip. (6)

12. (a) (i) List the different types of addressing modes supported by the 8085 microprocessor with examples. (4)

(ii) Write an assembly language program using 8085 to find sum of even numbers in a given series containing 8-bit numbers stored in a continuous memory location and store the result in another memory location. (9)

Or

(b) List the categories under which the instructions in the instruction set of the 8085 microprocessor are grouped. Explain the operation of any two instructions in each group.

13. (a) With a functional block diagram, briefly discuss the architecture of the 8051 microcontroller.

Or

(b) (i) Differentiate RET and RETI instructions. Explain why RET cannot be used as the last instruction of an ISR instead of RETI. (6)

(ii) Illustrate the options available with Timer Mode (TMOD) register of 8051. (7)

14. (a) Describe the operating modes and control words of 8255. Also, specify the handshaking signals and their functions if port A of 8255 is setup as input port in mode 1.

Or

(b) Show how the 8085 micro processing unit is interfaced with the analog to digital converter using the interrupt. Also, explain the principle and control signals involved in the analog to digital conversion process.

15. (a) Explain how to interface a 8×4 matrix keyboard to 8051 microcontroller. Also, Write an assembly language program to show how 8051 detect a key press and identify the key pressed.

Or

(b) Explain how to interface a servo motor with 8051 microcontroller. Also, write an assembly language program to control the angular position of servo motor using 8051 microcontroller.

PART C — ($1 \times 15 = 15$ marks)

16. (a) Describe the need for timing diagram in 8085 microprocessor. Also, show the timing diagram for execution of IN 3AH instruction. (Assume the machine codes DBH and 3AH generated for the instruction IN 3AH are available in locations 4065H and 4066H respectively).

Or

(b) Show how to interface a stepper motor to 8051 microcontroller. Also, write an assembly language program to demonstrate control of direction and speed of stepper motor rotation.

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Question Paper Code : 50543

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Sixth Semester

Electrical and Electronics Engineering

EE 8602 – PROTECTION AND SWITCHGEAR

(Regulations 2017)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Name the different kinds of over current relays.

2. What are unit system and non-unit system?

3. What are the various faults to which a turbo alternator is likely to be subjected?

4. Mention any two disadvantage of carrier current scheme for transmission line only.

5. What are the various faults that would affect an alternator?

6. Why busbar protection is needed?

7. How does a numerical over current relay work?

8. What are the advantages of static relays over electromagnetic relays?

9. Write the classification of circuit breakers based on the medium used for arc extinction?

10. What are the advantages of MOCB over a bulk oil circuit breaker?

PART B — (5 × 13 = 65 marks)

11. (a) Classify the different faults in power system. Which of these are more frequent?

Or

(b) Explain the various methods of earthing the neutral point of the power system with a neat sketch.

12. (a) With a neat Diagram, explain the construction and operation of the Directional over the current relay.

Or

(b) Discuss in detail various types of Differential relays.

13. (a) Explain transformer protection using the following methods

(i) Differential protection (Merz-price protection). (6)

(ii) Buchholz relay. (7)

Or

(b) Discuss the protection of a Transmission line.

14. (a) Discuss the block diagram of numerical over current protection with a neat sketch along with its flowchart.

Or

(b) Describe with a neat block diagram the working of the solid state relays.

15. (a) Explain the construction, and operating principle of the Vacuum circuit breaker with a neat diagram.

Or

(b) Explain with a neat sketch the construction, and operating principle of the Air blast circuit breaker with its merits and demerits.

PART C — (1 × 15 = 15 marks)

16. (a) A circuit breaker is connected with 100MVA transformer at 220kV. The magnetizing current of a transformer is 5% of the full load current. Determine the maximum voltage which may appear across the gap of the breaker when the magnetizing current is interrupted at 53% of its peak value. The stray capacitance is 2500 μF. The inductance is 30H.

Or

(b) A generator is protected by restricted earth fault protection. The generator ratings are 13.2kV, 10 MVA. The percentage of winding protected against phase to ground fault is 85%. The relay setting is such that it trips for 20% out of balance calculate the resistance to be added in the neutral to ground connection.

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Question Paper Code : 50544

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023

Sixth/Seventh/Eighth Semester

Electrical and Electronics Engineering

EE 8691 – EMBEDDED SYSTEMS

(Common to Electronics and Instrumentation Engineering / Instrumentation and Control Engineering)

(Regulations 2017)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Write three key functional requirements of an embedded system.
2. Distinguish between CISC and RISC.
3. List down at least three important features of SPI.
4. What is the role of device drivers in an embedded system?
5. What is an object – oriented model?
6. What are the processes involved in co-design?
7. Define threading and multi-threading?
8. What is priority inversion?
9. What is a prototype?
10. What are the events involved in smart card application?

PART B — (5 × 13 = 65 marks)

11. (a) With a neat diagram explain the working of direct memory access architecture and timing diagram. (13)

Or

(b) Discuss real time clock and target hardware debugging. (13)

12. (a) Explain the following communication protocols in detail: CAN BUS and I^2C BUS. (7+6)

Or

(b) Explain the I/O device ports and their characteristics. (13)

13. (a) Explain sequential programming model with an example. (13)

Or

(b) (i) Highlight the issues and challenges in software–hardware Co-design. (7)

(ii) Discuss the different phases of EDLC in detail. (6)

14. (a) Explain inter process communication in detail. (13)

Or

(b) Explain how interrupt routines are handled by RTOS. (13)

15. (a) Explain the working of automotive camera controller with suitable sketches. (13)

Or

(b) Explain embedded design concept used in debit card payment machine with necessary diagrams. (13)

PART C — (1 × 15 = 15 marks)

16. (a) Consider the modern washing machine which is an embedded system-enabled product.

(i) Draw the functional architecture of the system and explain how software is interacting the hardware (include the necessary diagram and flow chart) (8)

(ii) Analyze the following cases: washing and spinning with normal load and overload. (7)

Or

(b) Explain state machine model for an automatic seat belt warning system with necessary diagrams and flowcharts. (15)

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Question Paper Code : 50509

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023

Sixth Semester

Electrical and Electronics Engineering

EE 8005 – SPECIAL ELECTRICAL MACHINES

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Why stepper motor works in external logic circuit?
2. What is holding torque in stepping motors?
3. What is the significance of closed loop control in switched reluctance motor.
4. Write the torque equation of switched reluctance motor.
5. What is the effect of demagnetization in brushless PMDC motors?
6. List the types of materials used in PMBLDC motors.
7. How permanent magnet synchronous motor is started?
8. What are slotless motors?
9. List out any four properties of reluctance motors?
10. Define cogging.

PART B — (5 × 13 = 65 marks)

11. (a) (i) Describe the operation of a variable reluctance type stepper motor. (6)

(ii) What is stepping angle? Calculate the stepping angle for a 3-phase, 24- pole permanent magnet type stepper motor. (7)

Or

(b) (i) Explain with neat diagram the multistack configuration in stepper motors. (6)

(ii) Explain the working of hybrid motor. (7)

12. (a) (i) Draw the torque speed characteristics of switched reluctance motor. (6)

(ii) Explain the shaft position sensing of SR motor. (7)

Or

(b) Discuss the necessity of power electronic circuit in SR motor. Explain the different types.

13. (a) Describe the construction of a permanent — magnet DC motor. List the advantages of it compared with conventional DC motor.

Or

(b) (i) Derive the Torque equation of brushless DC motor. (6)

(ii) Discuss about the power controllers used in PMBDC motor. (7)

14. (a) (i) Explain the principle of operation of permanent magnet synchronous motor. (6)

(ii) Derive the emf equation of permanent magnet synchronous motor. (7)

Or

(b) Explain about

(i) Torque speed characteristics (6)

(ii) Microprocessor based control system (7)

In permanent magnet synchronous motor.

15. (a) Draw and explain the constructional features and principle of operation of synchronous reluctance motor. (13)

Or

(b) (i) With neat diagram explain the characteristics of hysteresis motor. (6)

(ii) Explain the working principle of repulsion motor. (7)

PART C — (1 × 15 = 15 marks)

16. (a) Describe the position sensor that are used in PMBLDC motor and also the driving circuits employed.

Or

(b) Derive the thrust equation of an LIM and describe the transverse edge effects of LIM.

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Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 50506

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Sixth Semester

Electrical and Electronics Engineering

EE 8002 — DESIGN OF ELECTRICAL APPARATUS

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Draw the magnetic circuit of DC machine.
2. Mention the two types of armature winding used in dc machine and compare.
3. What are the advantages of stepped core in transformer and why it is generally used?
4. What causes temperature rise in transformers?
5. Define specific magnetic loading and give the ranges for DC machine design.
6. Mention the factors governing the choice of number of armature slots in a dc machine.
7. How are induction motor designed for best power factor?
8. What happens if the air gap length of Induction motor is doubled?
9. State the important features of turbo alternator rotor.
10. How to calculate the full load field MMF in synchronous machine?

PART B — (5 × 13 = 65 marks)

11. (a) (i) Briefly Discuss on any five limitations imposed during Electrical Machine Design. (6)

(ii) What is Leakage Flux in Magnetic Circuits? List some leakage fluxes available in the rotating machine. (7)

Or

(b) (i) Mention the properties of Insulating and Conducting materials used in electrical machines. (6)

(ii) Calculate the specific electric and magnetic loading of 100 HP, 300 V, 3 phase, 50 Hz, 8 pole star connected, flame proof induction motor having stator core length = 0.5 and stator bore = 0.66 m. Turns /phase = 286. Assume full load efficiency as 0.938 and pf as 0.86. (7)

12. (a) Estimate the main dimensions including winding conductor area of a 3 = phase, Δ-y core type transformer rated at 300 KVA, 6600/440 V, 50 Hz. A suitable core with 3-steps having a circumscribing circle of 0.25 m diameter and a leg spacing of 0.4 m is available. Emf/turn = 8.5V, δ =2.5 A/mm^2 K_w =0.28, S_f = 0.9. (13)

Or

(b) (i) Starting from the basic EMF equation derivation, Obtain an expression for EMF per turn in terms of output of the transformer. Write a note on factor K. (7)

(ii) Show the steps to estimate the No Load Current of a Three Phase transformer. (6)

13. (a) (i) Explain the procedure for the selection of number of poles in the machine. What are the advantages and disadvantages of large number of poles in a dc machine? (6)

(ii) For a preliminary design of a 40 HP, 230V, 1400 rpm, dc shunt motor. Calculate the armature diameter and core length, the no. of poles and peripheral speed. Take Bav = 0.5 wb/sq.m, ac/m = 25,000, efficiency = 0.9. (7)

Or

(b) Design a suitable commutator for a 350 KW, 600 rpm, 440 V, 6 pole dc generator having an armature diameter of 0.75 m. The number of coils is 288. Assume suitable values wherever necessary. (13)

14. (a) Estimate the stator core dimensions, number of stator slots and number of stator conductors per slot for a 100 kw, 3300v, 50 Hz, 12 pole star connected slip ring induction motor. Assume average gap density = 0.4 wb/m^2; Conductors per metre = 25,000 A/m, efficiency = 0.9, power factor = 0.9 and winding factor = 0.96. Choose main dimensions to give overall design. (13)

Or

(b) (i) Compare: slip ring and cage induction motor from design aspects. (5)

(ii) Design a cage rotor for a 40 HP, 3-phase, 400 V, 50 Hz, 6 pole delta connected IM having a full load efficiency of 87% and a full load pf of 0.85. Take D = 33 cm and L = 17 cm. stator slots = 54, conductors/slot = 14. Assume suitably the missing data of any. (8)

15. (a) (i) Determine the main dimensions of 1000 KVA, 50 Hz, 3 phase, 375 rpm alternator. The average air gap density is 0.55 Wb/m2, ampere conductor/meter 28000. Use rectangular poles, assume ratio of core length to pole pitch as 2. Max permissible peripheral speed is 50 m/sec. The runaway speed = 1.8 times the synchronous speed. Assume winding factor as 0.995. (8)

(ii) Define short circuit ratio in connection with 3 phase synchronous generators. Discuss its effects on the machine performance. (5)

Or

(b) (i) Derive the expression for air gap length in cylindrical rotor machine. (7)

(ii) Give the purpose of providing damper windings in synchronous machines. (6)

PART C — (1 × 15 = 15 marks)

16. (a) (i) What are the different types of materials used in modern electrical machines? (8)

(ii) Compare: conventional DC motor and BLDC motor. (7)

Or

(b) A 1000 KVA, 6600/440V, 3-phase core type transformer has the following design details.

- Distance between centres of adjacent limbs = 0.47m
- Outer dia of HV winding = 0.44 m
- Height of frame = 1.24 m -
- Core loss 3.7 kW and I^2R Loss 10.5 kW

Design a suitable tank for transformer and show the arrangement of cooling tubes.

The average temperature rise is to be limited to 35°C. The diameter of tubes is 50mm and the average height of tubes is 1.4 m. Allow clearance along width as 14 cm, breadth as 18 cm, and height as 60 cm. Specific heat dissipation due to radiation and convection is 6 and 6.5 w/mt²/°c respectively. Assume that convection is improved by 35% due to provision of tubes. (15)

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Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 50542

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Sixth Semester

Electrical and Electronics Engineering

EE 8601 — SOLID STATE DRIVES

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the advantages and disadvantages of group drive?

2. A motor of smaller rating can be selected for a short time duty. Why?

3. What are the disadvantages of ward Leonard system drive?

4. Write the expression for average output voltage of full converter fed dc drives.

5. Why induction motor is most suitable for fan type loads?

6. A 3-phase, 460V, 60 Hz, 4 pole induction motor delivers rated output power at a slip of 0.05. Determine (a) Motor speed and (b) Frequency of rated current.

7. List the speed control methods used in synchronous motor.

8. Define torque angle of synchronous motor.

9. What are the functions of feedback loop in an electrical drive?

10. Mention the advantage of using PI type speed controller.

PART B — (5 × 13 = 65 marks)

11. (a) (i) A motor and load have the following characteristics,

$T = 15 - 0.5\,\omega_m$ and $T_L = 0.5\,\omega_m^2$. Find the stable operating speed. Check steady state stability. (8)

(ii) Explain in detail the multi quadrant dynamics in the speed-torque plane. (5)

Or

(b) (i) Draw the typical load torque-speed characteristics of fan, high speed hoist, traction and constant power loads. (5)

(ii) Discuss the different modes of operation of an electrical drive. (8)

12. (a) (i) The speed of a 10kW, 230 V, 1200 rpm separately excited dc motor is controlled by single phase fully controlled bridge converter. The armature resistance is 0.5 ohm and emf constant is 0.182 V/rpm. The single phase ac voltage is 260V. For firing angle of 30 deg and armature current of 30A. Find torque, speed and input power factor. (6)

(ii) Explain the operation of single-phase semi converter fed separately excited dc motor drive in continuous conduction mode and obtain the expression for motor speed. (7)

Or

(b) (i) A 220 V, 24 A, 1000 rpm separately excited dc motor is controlled by a chopper. Assume armature resistance of 2 Ω. The chopping frequency is 500 Hz and the input voltage is 230 V. Calculate the duty ratio for a motor torque of 1.2 times of rated torque at 500 rpm. (6)

(ii) Explain the various control strategies for varying the duty cycle used in chopper drives. (7)

13. (a) (i) Implement the stator voltage control for three phase induction motor using bidirectional ac voltage controller. (8)

(ii) Explain the speed control of slip ring induction motor using rotor resistance control. (5)

Or

(b) (i) Show that the no-load speed of the induction motor in the kramer drive can be varied from near standstill to full speed as the firing angle α is varied from 180° to 90°. (9)

(ii) Compare static Kramer and static Scherbius scheme of speed control. (4)

14. (a) (i) Discuss about the voltage/frequency (V/f) control of synchronous motor drives. (6)

(ii) Explain the margin angle control of synchronous motor drives. (7)

Or

(b) Describe the operation of self-controlled mode speed control for synchronous motor. (13)

15. (a) Derive the closed loop transfer function of converter fed separately excited DC motor drive. (13)

Or

(b) (i) Explain the design procedure of speed controller. (7)

(ii) List the factors involved in converter selection and write the equations involved in controller characteristics. (6)

PART C — (1 × 15 = 15 marks)

16. (a) (i) A 2.8 kW, 400 V, 50 Hz, 4 pole, 1370 rpm, delta connected squirrel cage induction motor has the following parameters referred to the stator:

$R_1 = 2\ \Omega$, $R_2 = 5\ \Omega$, $X_1 = X_2' = 5\ \Omega$ and $X_m = 80\ \Omega$. Motor speed is controlled by stator voltage control. When driving a fan load it runs at rated speed and rated voltage. Calculate motor terminal voltage, current and torque at 1200 rpm. (5)

(ii) Starting from the approximate equivalent circuit, derive an expression for the torque developed in an induction motor. Sketch the torque-speed characteristics when stator voltage is varied. (10)

Or

(b) Develop a typical closed loop control scheme for three phase induction motor drive controlled in field weakening mode.

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Question Paper Code : 50546

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Seventh Semester

Electrical and Electronics Engineering

EE 8702 — POWER SYSTEM OPERATION AND CONTROL

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define load curves and give the types.

2. Write the necessary conditions for two synchronous generators sharing the load in parallel operation.

3. Give the advantages of the AVR loop over ALFC.

4. Draw the block diagram representation of two area systems.

5. List the sources of reactive power and its controlling methods.

6. When is feedback stability compensation used?

7. Differentiate the economic load dispatch and optimal power flow.

8. What are the objectives of hydrothermal scheduling?

9. Give the functions of the control center.

10. What is weighted least square estimation?

PART B — (5 × 13 = 65 marks)

11. (a) Explain the necessity of voltage and frequency regulation in the power system.

Or

(b) What are the components of the speed governor system of an alternator? Derive mathematical model of the speed governor system with aid of a block diagram.

12. (a) Draw the transfer function block diagram for a single area system provided with static analysis of an uncontrolled case and controlled case.

Or

(b) Explain with a neat block diagram the integration of economic dispatch with toad frequency control.

13. (a) (i) Demonstrate in brief the brushless excitation system. (7)

(ii) Point out the relations between voltage, power, and reactive power at a node for applications in power system control. (6)

Or

(b) Explain the operation of TCR and TSC with necessary V-I characteristics.

14. (a) What is meant by unit commitment? and briefly explain the constraints on unit commitment.

Or

(b) Consider two units of a plant that have fuel costs of

$F_1 = 0.2P_1^2 + 40P_1 + 120\,Rs./h$

$F_2 = 0.25P_2^2 + 30P_2 + 150\,Rs./h$

(i) Determine the economic operating schedule and the corresponding cost of generation for the demand of 180 MW. (7)

(ii) If the load is equally shared by both units, determine the savings obtained loading the units optimally. (6)

15. (a) Briefly discuss the energy control centers and their functions.

Or

(b) Describe the various functions of SCADA in the control of power systems.

PART C — (1 × 15 = 15 marks)

16. (a) A 132 kV line is fed through an 11/132 kV transformer from a constant 11 kV supply. At the load end of the line, the voltage is reduced by another transformer of a nominal ratio: 132/11kV. The total impedance of the line and transformers at 132kV is (25+j66)V. Both transformers are equipped with tap-changing facilities which are arranged so that the product of the two off-nominal settings is unity. If the load on the system is 100 MW at 0.9 p.f. lagging. Calculate the settings of the tap-changers requited to maintain the voltage of the load bus bar at 11 kV Use a base of 100 MVA.

Or

(b) Analyze the economic dispatch of thermal units considering with and without transmission losses.

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Question Paper Code : 50545

B.E./B.Tech DEGREE EXAMINATIONS, APRIL/MAY 2023.

Seventh Semester

Electrical and Electronics Engineering

EE 8071 – HIGH VOLTAGE ENGINEERING

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the basic requirements of a lightning arresters?

2. What are the effects of corona on power system?

3. State Paschen's law.

4. Name the different types of breakdown mechanisms in commercial liquid dielectrics.

5. Why is controlled tripping necessary in impulse generators?

6. What are the applications of high voltages?

7. What are the design used in high resistive shunt for reducing stray effects?

8. What are the limitation of series resistance micro-ammeter method for high voltage measurements?

9. Define disruptive discharge voltage.

10. What is meant by insulation coordination?

PART B — (5 × 13 = 65 marks)

11. (a) (i) Discuss briefly about the various causes of power frequency overvoltage in power system and methods to control them. (8)

(ii) Explain with neat sketches the mechanism of lightning discharge. (5)

Or

(b) (i) Explain how overvoltage in transmission line due to lightning can be minimized by ground rods and counterpoises? (8)

(ii) What is tower-footing resistance? Discuss the two methods to reduce this resistance. (5)

12. (a) (i) Explain the mechanism of development of anode and cathode streamers and explain how these lead to breakdown in gaseous dielectrics. (8)

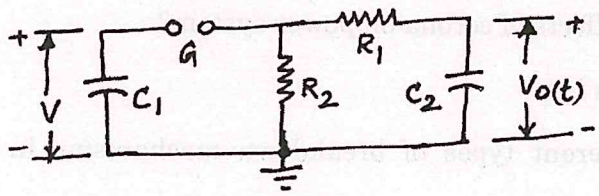
(ii) Explain the breakdown due to internal discharges in solid dielectrics. (5)

Or

(b) (i) Explain the various mechanism of breakdown in composite dielectrics in detail. (8)

(ii) What are the important properties of composite dielectrics to be considered for their performance? (5)

13. (a) Give complete analysis of the given single-stage impulse voltage generator circuit and derive the condition for physical realization of wave front and wave tail resistances. (13)



Or

(b) What is a Tesla coil? Derive an expression for damped high frequency oscillation output voltage in a Tesla coil. Also give its advantages. (13)

14. (a) (i) Explain with neat schematic diagram, the working principle and operation of generating voltmeter for measuring high DC voltages. (8)

(ii) Explain the operation of digital peak voltmeter for measurement of high AC voltages. (5)

Or

(b) (i) With phasor diagram, explain how a tuned capacitance voltage transformer can be used for measuring high alternating voltages in power system. (8)

(ii) Discuss the performance of various capacitance potential dividers for measurement of impulse voltages. (5)

15. (a) Explain in details about the procedure for conducting power frequency, impulse voltages and pollution tests on high voltages insulators. (13)

Or

(b) Explain the method of impulse testing of high voltage transformers. What is the procedure adopted for locating failure? (13)

PART C — (1 × 15 = 15 marks)

16. (a) Consider a long transmission line is energized by a unit step voltage 1.0 V at the sending end and is open circuited at the receiving end. Construct the Bewley Lattice diagram and obtain the value of voltage at the receiving end after a long time. Take the attenuation factor $\alpha = 0.8$. (15)

Or

(b) A ten stage cockcroft-Walton voltage multiplier circuit has all capacitors of 0.06 μF. The secondary voltage of supply transformer is 100 kV at a frequency of 150 Hz. If the load current is 1 mA, determine the following (15)

(i) voltage regulation,

(ii) the ripple voltage,

(iii) the optimum number of stages for maximum output voltage, and

(iv) the maximum output voltage.

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Question Paper Code : 50547

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Seventh Semester

Electrical and Electronics Engineering

EE 8703 — RENEWABLE ENERGY SYSTEMS

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. List out the methods to reduce the greenhouse effect.

2. What are the limitation of solar energy utilization techniques?

3. List the advantages of wind energy.

4. What do you understand by the term of solidity ratio of the wind turbine?

5. List out the advantages of concentrating collector over flat plate collector.

6. The maximum efficiency of the solar cells are very low – Justify this statement.

7. Draw the aerobic digestion of organic waste by 3 stage biochemical processing techniques.

8. Identify the environmental impact of extraction geothermal energy.

9. Compare the fuel cell and battery.

10. Define the tidal range with respect to tidal power plant.

PART B — (5 × 13 = 65 marks)

11. (a) Brief about the contribution of renewable energy source as on 2022 under National and International level in energy consumption and generation scenario. Also forecast the Indian future energy management in 2040. (8+5)

Or

(b) Explain the consequence of environmental impact of fossil fuel utilization. Mention the importance of the renewable energy source for the present Scenario. (6+7)

12. (a) Draw the line diagram of various types of wind mill blades and write their advantages and disadvantages.

Or

(b) In a particular site, the atmospheric pressure is 1.01325 bar and temperature is 25°C. The wind is available at 9 m/sec. Evaluate the following :

(i) Power density available in the site (3)

(ii) Maximum Power density possible (3)

(iii) Obtainable power density assuming the over all efficiency is 35% (3)

(iv) Power density of the windmill if the diameter is 50 m and (2)

(v) Axial thrust force action on the wind mill blade. (2)

13. (a) As an Engineer, identify the favorable points for developing a solar thermal based power generation projects at your home town. Also share the merits and demerits of the same based on their performance. (8+5)

Or

(b) A photovoltaic cell has some open circuit voltage of 1.0 Volts and a short circuit current of 260 A/m^2, at a cell temperature at 28°C. Calculate the voltage and current density that maximizes the power of the cell. Estimate the corresponding maximum power output per unit cell area? If the solar radiation falling on the cell is 900 W/m^2, and the cell size is 25 cm × 25 cm, compute the instantaneous conversion efficiency of the cell? And give the value of Fill factor of cell.

14. (a) (i) Explain with neat sketch of various methods of energy harvesting techniques in geothermal source. List out their merits and demerits. (9+4)

(ii) Elaborate the site selection process for micro hydro power plant erection.

Or

(b) Explain any one type of gasifier with neat line diagram. Mention the merits and demerits of the same. (9+4)

15. (a) (i) Explain the methods of energy extraction technique on ocean tidal energy source. (5)

(ii) How do you estimate the power potential of ocean tidal energy source? (5)

(iii) List out the limitations of tidal energy conversion system. (3)

Or

(b) Explain the construction of various types of fuel cells.

PART C — (1 × 15 = 15 marks)

16. (a) (i) Explain with neat diagram of cow dung used biomass gasifier. (7)

(ii) Design a bio gas gasifier for a community hall located in Village of Yelagiri hills, Tamil Nadu. In this village has a total population of 300 families with 120 mens, 80 womens and 100 children. The bio gas consumption for food preparation of the tribalpeople are 300 litres for men, 200 litres for women and 100 litres for children respectively. A buffalo yields an average of 40 kg of dung every day. The average estimated the gas production from the dung is around 10 litres/kg of dung. Estimate the number of buffaloes required to meet the gas requirement for food preparation for that tribal people. The density of slurry is 1090 kg/m^3. Estimate the size of the digester if the Height : Diameter ratio is 3:1. (8)

Or

(b) (i) Design a Stand-along solar PV for an emergency 24 hours × 7 days clinic room. The following data were observed during the operation hours. The clinic has 10 tube lights, 5 Fans, 2 PC with 200 Watts, 1 Water cooler with 750 watts. Assume the average solar radiation available in Vellore is 800 W/m^2. Estimate and form array the battery and module requirements. (5)

(ii) The manager of the clinic wants reduce the electrical consumption by replacing all the tube lights LEDs of 28 Wafts with same light illumination. Redesign the sizing of solar PV system for the revised proposal. (5)

(iii) Suggest suitable hybrid system for uninterrupted power supply by completely renewable energy sources. (5)

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Question Paper Code : 50522

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Seventh/Eighth Semester

Electrical and Electronics Engineering

EE 8018 — MICROCONTROLLER BASED SYSTEM DESIGN

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Recall the guidelines for writing PIC microcontroller instructions

2. What is the need for status registers in PIC 16C6x?

3. Compare hardware interrupts with software interrupts.

4. List the features of timer 2.

5. Mention the steps involved in reading the busy flag.

6. Calculate Vout for the binary input 10011001 if R = 5 K'Ω and Iref = 2 mA in Digital to Analog Converter.

7. Recall the sequence to be followed in pipelining in the ARM processor.

8. Outline the significant features of the ARM instruction set.

9. What is meant by the co-processor interface in an ARM processor?

10. Define the term buffer data and write back in 5 stage pipeline.

PART B — (5 × 13 = 65 marks)

11. (a) (i) Categorize the instruction set of the PIC microcontroller and discuss each set with examples. (8)

(ii) Outline the features of the PIC16C7x microcontroller. (5)

Or

(b) (i) Enumerate the Architecture of PIC 16C7x with neat sketches. (8)

(ii) Outline the necessity of program and data memory organization in PIC 16C6x. (5)

12. (a) (i) Summarize the steps in the activation of interrupts in PIC 16C7x. (6)

(ii) Categorize the different sources of interrupts in PIC 16C6x and explain. (7)

Or

(b) (i) Summarize the importance of key switches in the PIC microcontroller. (7)

(ii) Write a program to create a delay of 1 Sec using timer 0. (6)

13. (a) Explain the mechanism of the Keyboard interfacing with the PIC microcontroller.

Or

(b) Summarize the concept of I^2C Bus in PIC Microcontroller.

14. (a) Examine the role of the Current Program Status Register (CPSR), memory system, supervisor mode, instruction set, I/O system, and ARM exceptions in the ARM processor.

Or

(b) Categorize and explain the memory hierarchy in the ARM processor.

15. (a) Summarize the 5-stage pipeline ARM organization.

Or

(b) Explain how ARM instruction is executed in the ARM processor.

PART C — ($1 \times 15 = 15$ marks)

16. (a) Write an assembly-level program to print a text in the r0 register and subroutine to output a text string immediately following the call.

Or

(b) With the help of an ARM processor, develop an Ericsson – VLSI Bluetooth Baseband Controller chip for Bluetooth-based communication.